NORTHEASTERN FOREST EXPERIMENT STATION, UPPER DARBY, PA.
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
WARREN T. DOOLITTLE, DIRECTOR
1971

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1970 at the Northeastern Station

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NORTHEASTERN FOREST EXPERIMENT STATION
Warren T. Doolittle, Director 1971

1970: GENERAL

1970 HAS BEEN a year of great change and progress for the Station. We would like you to look back with us and review some of the more pertinent happenings. Also, we invite you to look at the current activities and major new developments expected for the year ahead.

Personnel

Many changes in personnel have occurred during the year. Warren T. Doolittle became Station Director, succeeding Richard D. Lane, who accepted an assignment with Agricultural Research Service in New Delhi, India. Bernard F. Duffy became Assistant Director for Support Services, succeeding Robert Bain, who moved over to a new position as Assistant to the Director. Gerald C. LaVoy transferred to the Pacific Southwest Station, and Dean A. Foote became Personnel Officer. Foote came to Upper Darby from the Jefferson National Forest in Virginia. Ronald V. Rydberg and Earle B. Grant also left the Personnel Section during the year. Rydberg became Personnel Officer on the Ozark-St. Francis National Forests in Arkansas, and Grant became Administrative Assistant at our Durham, N. H., unit behind Francis LaMorge, who transferred to State and Private Forestry at Portsmouth, N.H.

Francisco A. Ribeiro replaced Earle Grant; Ribeiro came to Upper Darby from Region 5, Forest Service, in California.

In the field, Jack W. Thomas became Project Leader of the new environmental research unit at Amherst, Mass. Thomas transferred from the wildlife habitat unit at Morgantown, W. Va. Brian R. Payne also joined the Amherst unit; an economist, he transferred from the Southern Station. Carter B. Gibbs became Project Leader at Orono, Maine, behind Arthur C. Hart. Gibbs moved over from Burlington, Vt.

Ronald Z. Whipkey left the watershed unit at Columbus, Ohio, and joined the Agricultural Research Service in Burlington. Gerald M. Aubertin transferred from the same unit at Columbus to the watershed unit at Parsons, W. Va. Ivan L. Sander transferred from the silviculture unit at Berea, Ky., to the North Central Station at Columbia, Mo. Russell S. Walters transferred from Berea to Burlington; Lawrence O. Safford transferred from Orono to Durham; and John C. Bjorkbom transferred from Orono to Warren, Pa. David Marquis became Project Leader at Warren.

Lawrence D. Garrett became Project Leader of the new sugar maple marketing research unit at Burlington; he transferred from Princeton, W. Va. Paul E. Sendak and Neil K. Huyler also joined the marketing unit at Burlington to round out the scientist staff.

During the year, two of our scientists retired. Dr. Howard W. Lull, an outstanding watershed-management research scientist in Upper Darby, retired in October 1970. Harold J. Huntzinger, silviculturist at Warren, retired in the spring of 1970.

Finally, we want to point out how we helped the women's liberation movement along by setting up Mrs. Phyllis C. Linville as the first woman Administrative Assistant (Morgantown) in the Station.

Information Services

During the late 1960's, the public awoke to the plight of their environment. In 1970 they clamored for facts about environmental problems and for information about proposed solutions. Our Information Services geared its program to provide relevant forestry research information. Our brochure, entitled "More Than Trees",

presented our research as an environmental effort concerned more with benefits to man than merely with trees. Our environmental efforts have been publicized on television, on radio, and in newspapers and magazines. Information Services handled over 40,000 requests for its photo stories and leaflets and brochures, in addition to generating and handling over 15,000 requests for Station technical publications. Our material went into media reaching over 200 million people.

Research Publications

The Station produced 215 publications during the year, of which 64 were printed by the Station and 151 were published in various scientific, professional, and trade journals. See the list at the end of this report.

Our Publications Branch continued its efforts to reduce the time required for editorial processing. Meanwhile a special training effort was made to increase the writing skills of Station scientists. Several training guides were prepared, including "An Editors' Notebook for Authors", which is being distributed to Station personnel in loose-leaf form.

Biometrics

Donald W. Seegrist was appointed head of our Biometrics Branch. Seegrist received his Doctor of Philosophy in Zoology with a minor in Statistics from the University of California, Berkeley. The Biometrics Branch has investigated multivariate techniques. Application of multivariate techniques to forestry problems will increase as computer programs become available. The branch reviewed numerous study plans and manuscripts and completed many statistical analyses for our scientists.

Engineering

A 22,000-square-foot addition to our Delaware, Ohio, Laboratory was completed and dedicated during the year. Also, design work was started on a new wing at our Princeton, W. Va., Laboratory. Steady progress was made toward developing comprehensive maintenance schedules and plans for our existing facilities.

RESEARCH ACCOMPLISHMENTS

Symposiums

In August 1970 we sponsored a symposium on "Trees and Forests in our Urbanizing Environment". The purpose of this symposium was to explore the role of forests in providing a better environment for man and to outline the sociological and political factors that affect forests and the environment. Over 300 people heard speakers in disciplines ranging from sociology and meteorology to forestry and wildlife. The symposium was co-sponsored by the Cooperative Extension Service in cooperation with the Departments of Landscape Architecture and of Forestry and Wildlife at the University of Massachusetts, the Massachusetts Department of Natural Resources, and Northeastern Area—State and Private Forestry of the USDA Forest Service.

We held a 2-day symposium on hardwood sawlog weight-volume relationships at our Princeton Marketing Laboratory in July. About 40 representatives from State and Federal agencies and timber industry firms attended. We presented new information on sawlog weights by species, diameter, and length that will help those wishing to shift from volume scaling to weight scaling. The symposium was co-sponsored by Northeastern Area—State and Private Forestry.

Preparations for the Oak Symposium, to be held in Morgantown, W. Va., 16 to 20 August 1971, are progressing rapidly. This symposium will be sponsored jointly by West Virginia University, the USDA Forest Service, the Appalachian Hardwood Manufacturers, Inc., and the West Virginia Department of Natural Resources. Plans call for 27 papers on topics covering historical, biological, and economical aspects of oak management.

Preparations are also well under way for a Symposium on Recreation to be held at Syracuse, New York, 12 to 14 October 1971. The program will include 25 papers by experts representing Federal and State agencies and universities from all parts of the country. The symposium will be sponsored by the State Uni-

versity of New York College of Forestry, the USDA Forest Service, the New York State Department of Environmental Conservation, the New York State Office of Parks and Recreation, and the National Recreation and Parks Asssociation.

Maple Products Marketing

New research has been undertaken at Burlington, Vt., to identify methods for increasing market acceptance for maple syrup and related products. This research group will investigate problems of marketing related to consumer preference, market structure, and product performance, and will study problems of production associated with the economic evaluation of new technologies and factors of production such as labor and size of operations.

Environmental Forestry Research Initiated

A new research unit was established at Amherst, Mass., last year. This group, located on the campus of the University of Massachusetts, will conduct research on forests and trees as they relate to the human environment in the densely populated areas of the Northeast. The research program at Amherst will be conducted in cooperation with the University and will include studies of non-game wildlife habitat, recreation for urban people in a forest environment, landscaping forest vegetation, genetic improvement of forest vegetation for areas of intensive human use, and models for evaluating alternative uses of urban forest lands.

Also, during the year, the Station established the Pinchot Institute of Environmental Forestry Research, headquartered at Upper Darby, Pa., which will encompass the Amherst unit described above and several other Station research units working on environmental problems in the costal megalopolis of the Northeast. The Institute will also include a consortium of northeastern universities in a cooperative research program, which the Station will support through grants. Thus the Institute will be composed of a mixture of Station and university research studies—in an overall coordinated and cooperative program. Members of the consortium include the universities of New Hampshire and Connecticut; Massachusetts Agricultural Experiment Station; Cornell

University Agricultural Experiment Station; Yale University; Pennsylvania State University; Rutgers University; Princeton University; and the State University of New York College of Forestry.

At Delaware, Ohio, the Station has formed a new unit to conduct research on air pollution as it relates to the hardwood forests of the Northeast. This unit will study (1) the effect of air pollution as a damaging agent to trees; (2) the effect of air pollution as an agent in predisposing trees to diseases; and (3) the ameliorating effect trees have on air pollution.

Stocking, Growth, and Yield of Oak Stands

Our research in even-aged upland oak stands, spanning a period of over 20 years, has provided much-needed information about the fundamental relationships of stocking, growth, and yield. We can now make confident recommendations for the management and culture of oak stands, based on yields of timber products. We found that most oak stands have sufficient stocking to utilize the site, but are deficient in high-quality trees. Thinning such stands offers a good opportunity to upgrade the relative quality of the growing stock and to enhance the growth and yield potential. The physical yields of timber products are greatest when thinnings are made from below, are begun at an early age, and are continued at 10- to 15-year intervals.

The age at which thinning begins is one of the most important factors. Our results show that the yield increase in cubic-foot volume and standard cords is over 50 percent greater when thinning begins at age 10 than when it begins at age 60. The latest age to begin thinning, for any significant effect on pulpwood production, is between 30 and 40 years; for sawtimber production it is between 50 and 60 years.

Our studies have also shown that, though thinning will increase the diameter growth of young even-aged oak and yellow-poplar saplings, very heavy thinning may markedly reduce the height growth of 7- to 9-year-old saplings. To achieve rapid diameter growth without sacrificing height growth, total release of crop trees should be avoided; and densities of about 60 percent of normal stocking should be maintained.

Ecological Research

Our silvicultural techniques are rooted in ecological research. For instance, our preliminary estimates indicate that timber utilizes only 1/10 to 1/5 percent of the net solar energy that enters a northern hardwood stand. Most of this energy is tied up in leaf production rather than in wood production. The possibilities for increasing the efficiency of these stands through fertilization, genetic improvement, and optimum thinnings appear great.

We are continuing to develop simulation models for predicting successional changes in three forest cover types in New England. Predicted and actual changes over a 25-year period have been reasonably consistent. Simulation of successional changes in northern hardwood stands allows us to: (1) point out changes in species trends and predict the rate of such changes; (2) estimate the probability of a species becoming extinct in the absence of positive management; and (3) reconstruct the ecological history of specific northern hardwood stands.

We have explored methods of managing forest understories for aesthetic purposes, and we find that many possibilities exist for favoring a wide assortment of pleasing shrubs and herbs. Methods for developing attractive understories on various sites and for several forest types in southern New Jersey have been suggested. However, the potentials of this work have just been scratched, and there is much to learn about the impact of forestry and other land-use practices on attractive shrubs and herbs in other forest types of the Northeast.

Biological Insect Control

Earlier studies in the laboratory have identified a virus that shows promise for control of the European pine sawfly. Now a mass-rearing technique for production of this nuclear polyhedrosis virus has been perfected. In conjunction with the production method, an easy and efficient chemical method for decontamination of the viral suspensions has also been developed. Animal safety tests of these decontaminated suspensions indicate no ill effects on bees, rabbits, guinea pigs, or rats. Consequently, this biological control technique will be ready for field tests in the very near future.

Dutch Elm Disease Breakthrough —A Biological Control?

For more than 25 years, American scientists have been searching for a better way to control Dutch elm disease. The fungus, which is carried from tree to tree by tiny beetles, has already killed more than 12 million elms. It continues to threaten the remaining 13 million by killing an additional 400,000 each year.

But now a new method of control may have been discovered. In field studies of the beetles that carry the disease, a team of scientists from the Forest Service and the state University of New York College of Forestry has shown that the virgin female beetles produce a chemical scent that attracts both male and female beetles. This scent might be used to attract or confuse the beetles and prevent them from spreading the deadly disease.

Discoloration and Decay Research

Fungi have been considered for over a century to be the principal microorganisms associated with discolored and decayed wood in living trees. But studies now show that bacteria are also important in the processes that result in discoloration and decay after wounding. Cooperative studies with bacteriologists at the University of Connecticut have resulted in characterizing some of the principal bacteria associated with discolored and decayed wood in beech, birch, and maple. This information will give us a more complete picture of the microorganisms intimately involved in the first wave of infection after wounding.

In the past, we have geared our efforts of prevention and control toward the fungi. Now we must consider the bacteria also. This means that our approach to the diseases must be changed. But it also means that our chances will be better for finding effective methods for prevention and control of discoloration and decay.

Physiological studies on some of the major fungi associated with decay in living beech, birch, and maple trees showed that growth in culture was affected by minute amounts of manganese, calcium, zinc, and iron. These metals may play an important role in the processes that result in discoloration and decay of wood

after wounding in living trees. The rate of decay by certain fungi may depend on the amount of these metals present. Application of materials to wounds that increase, decrease, or alter the micro-elements in wood may be a way for control.

The Pill and Sugar Maple

Pills of paraformaldehyde are used commonly in tapholes in sugar maple trees to increase the yield of sap collected for making syrup and sugar. But what happens to the tree when the chemical is used? Our research in Vermont showed that, 60 days after the pills were used during the 1969 tapping season, the wood above and below the tapholes was killed. Just as many microorganisms were in the wood surrounding the tapholes that contained the pill as were in wood surrounding control holes without the pill. We are continuing to study the long-range effect of the pill on wood in sugar maple.

Just How Rough is That Forest Road?

Because commercial instruments capable of handling the variations encountered during our studies of roughness of logging roads were not available, our engineering research unit at Morgantown, W. Va., has developed a gyroscopic instrument for precisely measuring logging-road roughness. Based on an aircraft gyropilot, the instrument provides a continuous chart record of vehicle pitch and roll while traveling over logging roads. In addition to research uses, with further development and testing, we foresee its application in determining maintenance requirements for forest roads—a considerable improvement over present seat-of-the-pants estimates.

An Approach to Resolving Resource Conflicts

Land managers constantly face conflicts among users of various resources. These conflicts are hard to resolve. Though the value of some resources such as timber are rather easily quantified and predicted, others such as wildlife are not. Two of our scientists—one an economist, the other a wildlife biologist—have adapted

economic methods for comparing alternative courses of action for identifying and resolving these conflicts.

While recognizing that complete information is not available in all cases, they believe that we know enough to at least recognize the critical factors in management for each resource, to broadly predict effects of manipulating each factor separately, and to display the interactions among management choices. Display of these interactions on relative scales of benefits allows more objective judgments to be directed toward management goals. As a first step, our scientists have considered wildlife and timber conflicts, but the techniques can be used in other resource conflicts as well.

Water Quality After Timber Harvest

In 1969, on the Fernow Experimental Forest in West Virginia, the hardwoods on an 86-acre watershed were harvested as they might be in a normal clearcutting operation. In this harvest, a protective strip of timber was left along the stream that drains the watershed. Water quality in the stream (including nutrient levels) is being monitored. To date, water quality has been within public health standards for drinking water except for slight turbidity in the stream during heavy rain storms or snowmelt (stormflows).

By contrast, on a watershed in New Hampshire kept clear by cutting and repeated herbiciding (an extreme experimental treatment), high nutrient levels were measured in stream water. Further investigations must be made to determine if the two watersheds differed because of experimental treatment, because of natural conditions, or because of both.

Total Forest Clearing and Stormflow

Analysis of stormflows after complete clearing—cutting followed by repeated application of herbicides, not to be confused with clearcutting for timber harvest—on a 39-acre watershed in New Hampshire showed increases in some seasons but not in others. Stormflow in the spring snowmelt season increased by as much as 2 area-inches, though decreases occurred in some high-

flow periods. Summer storm discharges were larger, by as much as 1.2 area-inches. Mean increases were much less. Stormflows occurring after soil-moisture recharge in the fall and before the start of spring snowmelt were not affected.

In light of the extreme nature of this experimental treatment and the relatively small proportion of forest land being harvested at any one time, this runoff should not cause concern about downstream flooding.

Accidents Cost Everyone

Accidents are costly. They cause injured workers pain and hardship and cost employers higher insurance and lower productivity. Accident costs are becoming more significant to the northeastern logging and sawmilling industry. In a study in cooperation with West Virginia University, we found that expenditures by logging firms for insurance increased labor costs by as much as 6 percent in West Virginia and by as much as 32 percent in Kentucky.

These rates are higher than for most industries—third only to mining and the erection of structural steel. Problems in workmen's compensation are discussed in two papers now in preparation.

Maine Timber Survey

Field work for the resurvey of the State of Maine was completed in December. This State contains more forest land than any other northeastern State. About 88 percent of the land area of Maine is forested. Forest plot data have been processed for about 70 percent of the State, and estimates of forest area and timber volume have been released in preliminary form.

These preliminary data show several trends. (1) The area of commercial forest land has increased slightly since the last survey. (2) Both growing stock and sawtimber have increased since the last inventory. (3) Net annual growth exceeds removals by nearly 2 to 1. (4) Certain major species such as white pine and yellow birch are being cut heavily; and in some areas, white pine removals exceed growth by a large margin.

Guides for Cooperative Forest-Management Activities

What kind of Cooperative Forest Management (CFM) activities aimed at timber production are worth undertaking?, and which should receive priority? We published an investment guide that gives CFM program administrators in Pennsylvania a basis for answering this question. This guide gives the public, private, and total costs of establishing sponsored planting and timber-stand-improvement (TSI) activities and gives the costs of providing harvesting and marketing assistance. Rates of return on investments in planting and TSI practices are calculated. These data are valuable for budgeting.

On better sites, precommercial thinning is the most desirable practice in cove hardwoods and northern hardwoods. On poorer sites, planting is more desirable than thinning or cleaning and liberation. When successful planting must be preceded by site preparation or followed by protective fencing, the additional costs cause the order of desirability to change.

SOLVE—A Program for Determining Sawlog Value

Appalachian sawmill operators face rising stumpage and harvesting costs and diminishing supplies of high-grade sawtimber. Competition for good timber is keen, and operators have trouble determining how much logs are worth.

To help sawmill owners with this problem, we developed a computer program that shows the maximum price that operators can afford to pay for delivered logs. This program, called SOLVE, gives dollar values for logs of different species, grades, diameters, and lengths. SOLVE can also be used to calculate values per thousand board feet for several different log rules.

The general SOLVE program must be tailored for an individual mill to give meaningful log values. Once the proper costs, yields, and prices are entered in the program, SOLVE quickly prints out maximum log values. Operators can use this information for evaluating the accuracy of previous bids or for purchasing delivered logs. Since the program allows the operator a prearranged profit and risk, he can pay a fair price for his logs.

1970 PUBLICATIONS

by staff members and cooperators
of the Northeastern Forest Experiment Station

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GENERAL

Doolittle, Warren T.
1970. **A new role for the Pinchot Institute.** Pa. Forest. 60(3): 81, illus.

On 20 July 1970 the Northeastern Forest Experiment Station launched a new research program, the Pinchot Institute of Environmental Forestry Research. The purpose of this program is to determine how trees and forests of the densely populated Northeast can best serve the needs of urban people.

Lane, Richard.
1970. **Research role in environmental forestry.** USDA Forest Serv. NE. Area State Foresters Annu. Meeting Proc. 5: 32-33.

Forestry research must provide the knowledge needed to make forest and tree resources contribute more fully to man's living environment. One step in this direction is establishment of the Pinchot Institute of Environmental Forestry Research by the Northeastern Forest Experiment Station.

Northeastern Forest Experiment Station.
1970. **1969 at the Northeastern Station.**
USDA Forest Serv. NE. Forest Exp. Sta., Upper Darby, Pa. 42 pp.
A report on the Station's activities and accomplishments in 1969, plus an annotated list of publications during the year.

Northeastern Forest Experiment Station.
1970. **More than trees.** USDA Forest Serv. NE. Forest Exp. Sta., Upper Darby, Pa. 16 pp., illus.
Forest research today is concerned with much more than trees. At the Northeastern Station, research covers timber management, watershed management, forest engineering, forest recreation, wildlife habitat, forest survey, forest economics, forest product marketing, forest product utilization, forest insects, and forest disease.

Northeastern Forest Experiment Station.
1970. **USDA Laboratories, Delaware, Ohio.**
USDA Forest Serv. NE. Forest Exp. Sta., Upper Darby, Pa. 6 pp., illus.
A fold-out brochure that encloses individual leaflets describing activities of the Forest Service Forest Insect and Disease Laboratory, the Forest Service State and Private Forestry Field Office, and the Agricultural Research Service Shade Tree and Ornamental Plants Laboratory housed in the Delaware Laboratory.

Northeastern Forest Experiment Station.
1970. **Man's best friend, the tree.** USDA Forest Serv. NE. Forest Exp. Sta., Upper Darby, Pa. 6 pp., illus .
A brochure describing the many ways in which trees enhance man's environment, with emphasis on the urban environment. Some notes on research now under way in environmental forestry.

Northeastern Forest Experiment Station.
1970. **Penobscot Experimental Forest.**
USDA Forest Serv. NE. Forest Exp. Sta., Upper Darby, Pa. 12 pp., illus.
A brochure describing this experimental forest near Bangor, Maine, where research is being carried on to develop new and better silvicultural methods for the successful regeneration, growth, and harvesting of spruce, fir, and associated species.

Northeastern Forest Experiment Station.
1970. **Trees—Nature's way to diminish noise.**
Wonderful W. Va. 34 (7): 10, illus.
Experimental work on sound propagation has shown that screens of trees can shut off enough noise to make the difference between an unpleasant situation and a fairly pleasant, livable environment.

Walton, Gerald S.
1970. **A note on nonrandomized Neyman-shortest unbiased confidence intervals for the binomial and Poisson parameters.** Biometrika. 57(1): 223-224.
Nonrandomized Neyman-shortest unbiased confidence intervals for the binomial and Poisson parameters are discussed and compared with other intervals for these parameters. Tables of the Neyman-shortest intervals for the binomial and the Poisson distributions are available from the author.

TIMBER MANAGEMENT

Allen, Rufus H., Jr., and David A. Marquis.
1970. **Effect of thinning on height and diameter growth of oak & yellow-poplar saplings.**
USDA Forest Serv. Res. Paper NE-173, 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Early thinnings in young even-aged sapling stands are desirable to maintain good species composition and improve diameter growth. This study verifies that diameter growth increases after thinning, but shows that height growth of 7- to 9-year-old sapling hardwoods may be markedly reduced after very heavy thinnings. To achieve rapid diameter growth without sacrificing height growth, total release of crop trees should be avoided, and densities of about 60 percent of normal stocking should be maintained.

Bruckel, D. W., and E. P. Johnson.
1969. **Effects of pH on rootability of** Thuja occidentalis. Plant Propagator 15(4): 10.
Cuttings of **Thuja occidentalis** L. collected in February were stuck in perlite at pH levels of 5.1, 6.0, 7.1, 8.0, and 9.3. The pH of the media was found to have an effect upon both the percent rooting and quality of roots. Best results were obtained with a media pH of 7.1.

Carmean, Willard H.
1970. **Site quality for eastern hardwoods.** In **The silviculture of oaks and associated species.** USDA Forest Serv. Res. Paper NE-144: 36-56. NE. Forest Exp. Sta., Upper Darby, Pa.
A review of direct and indirect methods of measuring site quality for eastern hardwoods, including a list of references.

Clark, F. Bryan.
1970. **Measures necessary for natural regeneration of oaks, yellow-poplar, sweetgum, and black walnut.** In **The silviculture of oaks and associated species.** USDA

Forest Serv. Res. Paper NE-144: 1-16. NE. Forest Exp. Sta., Upper Darby, Pa.

A discussion of the natural regeneration of oaks, yellow-poplar, sweetgum, and black walnut, including a list of references.

Dorn, Donald, and Virgil Flick.

1969. **Seed cleaning equipment for removing pulp from black cherry.** Tree Planters' Notes 20(3): 11-12, illus.

A method of removing the pulp from black cherry seeds was needed to process increasing quantities of seed used in research and management. A low-cost machine was developed that is capable of cleaning about 15 pounds of fruit per hour.. The savings the first year were estimated to be $820.

Frank, Robert M., and Lawrence O. Safford.

1970. **Lack of viable seeds in the forest floor after clearcutting.** J. Forestry 68:776-778, illus.

The viability of seeds of northern conifers apparently does not persist in the forest floor for more than 1 year. Forest managers should not rely on seed in the forest floor for natural regeneration of northern conifers.

Gabriel, William J.

1970. **Initiation and development of floral primordia in sugar maple.** (Abstr.) First N. Amer. Forest Biol. Workshop. Mich. State Univ., East Lansing.

Floral primordia seem to appear simultaneously on the apical meristem following the formation of two pairs of leaf primordia. By the onset of winter, male flowers are well developed, but female flowers are still rudimentary. Differentiation of an archesporial cell in the nucellar tissues just before bud burst marks the initiation of embryo sac and the embryo sac complement. The embryo sac complement is extremely late in completing its development.

Garrett, Peter W.

1970. **Early evidence of weevil resistance in some clones and hybrids of white pine.** USDA Forest Serv. Res. Note NE-117, 4 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

White pine species and hybrids are being tested for inherent resistance to the white-pine weevil. First-year results offer hopes of finding or developing resistance in this group. **Pinus monticola** had a low level of weeviling, while the hybrid between **P. strobus** X **P. wallichiana** was heavily weeviled. There is evidence that individual **P. strobus** trees with acceptable levels of weeviling can be located in natural populations.

Gibbs, Carter B., and H. Clay Smith.

1970. **Sugarbush management research.** Nat. Maple Syrup Dig. 9(3): 8-10, illus.

The need for planned development of sugarbushes and the lack of effective management guides has led to research on factors important to the development of sugarbushes from forest stands and plantations. This paper discusses the current

program, which involves tree spacing, fertilization, and the effects of conifer understory on sap and sugar yields.

Gingrich, Samuel F.
1970. **Effects of density, thinning, and species composition on the growth and yield of eastern hardwoods.** In **The silviculture of oaks and associated species.** USDA Forest Serv. Res. Paper NE-144: 26-35. NE. Forest Exp. Sta., Upper Darby, Pa.

A summary of present knowledge about the effect of density, thinning, and composition on the growth and yield of eastern hardwood forests—with emphasis on recent literature based on research.

Graber, Raymond E.
1970. **A new way to direct-seed white pine.** N.H. Forest Notes 101: 32-33, illus.

Research has developed a new way to direct-seed white pine effectively in the rough and stony terrain of New England. This paper describes the natural seeding of pine and the research necessary to allow Man to duplicate the results of nature within the tight bounds of economics.

Graber, Raymond E.
1970. **Natural seed fall in white pine** (Pinus strobus L.) **stands of varying density.** USDA Forest Serv. Res. Note NE-119, 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Seed fall was observed in three stands of mature white pines at stand basal-area densities of 80, 120, and 187 square feet per acre. It was found that the intermediate-density stand produced nearly 50 percent more seed than the stands of other densities. During a good seed year this stand produced 59 pounds of dry sound seed per acre. Most of the seeds were dispersed during a 7-week period beginning about the middle of September. The seed crop was reduced by action of birds, animals, and insects.

Hoyle, Merrill C.
1970. **Characteristics of IAA oxidase activity in yellow birch** (Betula Alleghaniensis). (Abstr.) First N. Amer. Forest Biol. Workshop. Mich. State Univ., East Lansing.

Yellow birch leaves were a potent source of IAA oxidase activity. Based on our results and results from the literature, we discuss the hypothesis that cofactor requirements for IAA oxidase activity are a peculiarity of **in vitro** assays and may not be absolute requirements for activity **in vivo.**

Hanover, J. W., and R. C. Wilkinson.
1970. **Chemical evidence for introgressive hybridization in Picea.** Silvae Genet. 19(1). 17-22.

Chromatographic patterns of phenolic compounds in the foliage of **Picea sitchensis, P. glauca,** and **P. engelmanii,** were analyzed to determine qualitative and semi-quantitative varia-

tion patterns associated with individual trees, geographic origins, and species. Several phenolic compounds among over 100 detected appear to be species-specific. Two of the distinctive phenolics provide a basis for determining the direction and possibly the degree of natural hybridization occurring between white and Sitka spruce.

Hoyle, M. C.

1970. **Growth and nutrition of yellow birch as affected by the nutrient status of a podzol soil.** In **Tree Growth and Forest Soils,** Third N. Amer. Forest Soils Conf. Proc.: 221-233, illus. Oregon State Univ. Press, Corvallis.

All mineral horizons of a podzol soil in New Hampshire were evaluated to determine location and nature of nutrient deficiencies and toxicities and to determine the severity of the conditions on yellow birch seedlings growing in a greenhouse.

Klawitter, Ralph A.

1970. **Does bedding promote pine survival and growth on ditched wet sands?** USDA Forest Serv. Res. Note NE-109, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results from a study of prepared beds for planting slash pine on a wet sandy flat in Florida were inconclusive. Early growth was improved, but survival was not; and differences between a bedded site and an unbedded site were slight.

Krochmal, Arnold.

1970. **Germinating pokeberry seed** (Phytolacca americana L.) USDA Forest Serv. Res. Note NE-114, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The seeds of pokeberry (**Phytolacca americana** L.) can be germinated successfully by storing them dry over winter and then nicking them with a needle to break the impermeable seed coat, followed by germination at about 75°F.

Krochmal, Arnold.

1970. **Wheat and bread in Afghanistan.** World Crops July/August: 1-6, illus.

Wheat is the principal crop and the principal source of food in Afghanistan, but a high incidence of rusts has resulted in a continuing crop shortage. This article describes the botany, rusts, cultural practices and research data for varietal trials and planting dates associated with wheat in Afghanistan.

Krochmal, Arnold, and Morris R. Henderson.

1970. **Empaque y embarque aereo de papayas.** La Hacienda Dec. 1970: 35-36, illus.

5,367 kilos of 'Solo' papaya grown experimentally by the Federal Experiment Station, USDA, in cooperation with local producers on St. Croix, U. S. Virgin Islands, were flown to San Juan, Puerto Rico, and marketed. Cost and return data and consumer acceptance were studied. Hotels and house-

wives received the fruit enthusiastically, the first grown commercially in the Caribbean. Growers made a net profit of 14.7¢ per kilo of fruit marketed.

Krochmal, Arnold, and Juanita Huguely.
1970. **Research of importance to the Christmas tree industry.** Amer. Christmas Tree J. 14(2): 17-21.
A list of Christmas tree research under way in the United States.

Krochmal, Arnold, and P. W. LeQuesne.
1970. **Pokeweed** (Phytolacca americana): **possible source of a molluscicide.** USDA Forest Serv. Res. Paper NE-177, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Pokeweed (**Phytolacca americana** L.) was found to have chemical similarities to an African plant (**Phytolacca dodecandra** L'Her) with demonstrated molluscicidal potency. This suggests a potential for fresh-water snail control. Uses, chemistry, propagation methods, and a listing of other potentially useful phytolacca species are presented.

Krochmal, Arnold, and Leon Wilken.
1970. **The culture of Indian tobacco** (Lobelia inflata **L.**). USDA Forest Serv. Res. Paper NE-181, 9 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Procedures are presented for growing **Lobelia inflata** L. (Indian tobacco) as a row crop under cultivation. Methods are described for seed collection, storing, and sowing; and conditions necessary for germination, transplanting, field planting, cultivation, harvesting, drying, and market preparation are outlined.

Krochmal, Arnold, Leon Wilken, and Millie Chien.
1970. **Lobeline content of lobelia inflata: structural, environmental, and developmental effects.** USDA Forest Serv. Res. Paper NE-178, 13 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
A study was made of **Lobelia inflata** L. to determine the quantity and distribution in the plant of lobeline (an alkaloid used in anti-smoking preparations) and the relationship between lobeline and soil factors. The highest concentration of lobeline is in the flowers, and the mature plant produces the greatest yields. No relationship was found between soil factors and lobeline content.

Leaf, Albert L., Raymond E. Leonard, John V. Berglund, Arthur R. Eschner, Patric H. Cochran, James B. Hart, Jr., Giles M. Marion, and Richard A. Cunningham.
1970. **Growth and development of** Pinus resinosa **plantations subjected to irrigation-fertilization treatments.** In **Tree Growth and Forest Soils,** Third N. Amer. Forest Soils Conf. Proc.: 97-118, illus. Oregon State Univ. Press, Corvallis.

Irrigation and K-fertilization trials were conducted in 37-year-old red pine plantations on a deep, sandy, K-deficient outwash soil. Moisture, temperature, nutrient element regimes, foliar nutrient levels, and growth were studied.

Leak, William B.

1970. **Sapling stand development: a compound exponential process.** Forest Sci. 16: 177-180.

The development of an even-aged stand during the sapling stage is expressed as a theoretical stochastic model referred to as the compound exponential process. Given a suitable estimate of the one parameter of the process, one can predict the probabilities and expectations of future numbers of trees by diameter classes.

Leak, William B.

1970. **Some preliminary estimates of energy utilization in even-aged northern hardwoods.** USDA Forest Serv. Res. Note NE-108, 7 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Estimates of energy utilization from various sources indicate that even-aged northern hardwood stands utilize less than ½ percent of net solar radiation for wood, leaf, and seed production of merchantable wood. Forest managers should seek to understand and manipulate the remaining 99+ percent of solar energy for improving the efficiency of merchantable wood production.

Leak, William B.

1970. **Successional change in northern hardwoods predicted by birth and death simulation.** Ecology 51: 794-801.

Two simulation models were used to predict species changes in three deciduous forest cover types in New England. A fixed-rate simulator, employing differences among species in birth/death rates, was used for stands approaching a steady-state condition. A density-related simulator, using birth and death rates related to both species and population size, was applied to stands in dynamic condition. Predicted and actual changes over a 25-year period were reasonably consistent.

Leak, William B., Peter H. Allen, James P. Barrett, Frank K. Beyer, Donald L. Mader, Joseph C. Mawson, and Robert K. Wilson.

1970. **Yields of eastern white pine in New England related to age, site, and stocking.** USDA Forest Serv. Res. Paper NE-176, 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Regression equations are presented for predicting cubic-foot and board-foot yields of unmanaged eastern white pine stands in New England from stand age. site index, and percent stocking.

Leak, William B., and Stanley M. Filip.

1970. **Cutting strategies & timber yields for unbalanced even-**

aged northern hardwood forests. USDA Forest Serv. Res. Paper NE-153, 19 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Linear programming was used to develop cutting strategies for four hypothetical even-aged northern hardwood forests with unbalanced age distributions that maximize board-foot yields and produce balanced age distributions by the end of the first rotation. Managed (thinned) and unmanaged (clearcutting only) approaches were compared, revealing large differences in board-foot yields.

Little, Silas, Jack McCormick, and John W. Andresen.

1970. **A selected and annotated bibliography of pitch pine** (Pinus rigida **Mill.**). USDA Forest Serv. Res. Paper NE-164, 103 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

This bibliography contains 590 annotated references to literature on pitch pine (**Pinus rigida**), grouped by distribution and resource statistics, botanical characteristics, forest ecology, silviculture and management, forest damage and protection, and wood technology and utilization.

McElwee, R. L.

1970. **Artificial regeneration of hardwoods.** In **The silviculture of oaks and associated species.** USDA Forest Serv. Res. Paper NE-144: 17-25. NE. Forest Exp. Sta., Upper Darby, Pa.

A discussion of the philosophy behind artificial regeneration of hardwoods, the role of artificial regeneration, and recommendations on artificial regeneration, including a list of references.

McQuilkin, William E.

1970. **To regenerate eastern hardwoods—clearcut.** Amer. Forests 76(6): 20-23, 48, 49, illus.

Selection cutting on eastern hardwoods does not work because it encourages only the shade-tolerant species. Even-aged silviculture (thus, clearcutting) is needed to encourage valuable intolerant species.

Minckler, Leon S., and Samuel F. Gingrich

1970. **Relation of crown width to tree diameter in some upland hardwood stands of southern Illinois.** USDA Forest Serv. Res. Note NC-99, 4 pp., illus. NC. Forest Exp. Sta., St. Paul, Minn.

Crown width-d.b.h. relationships in well-stocked, uneven-aged stands of oak and hickory were similar to those for open-grown trees and were independent of site, crown class, and species. The irregular crowns of forest grown trees interlace and overlap, however; and measuring crown extensions to the branch tips tended to overestimate effective crown area.

Nelson, Thomas C., and Malcolm J. Williamson.
1970. **Decorative plants of Appalachia . . . a source of income.** USDA Agr. Inform. Bull. 342. 31 pp.
This bulletin summarizes the present information about Appalachian forest plants that are commonly sold for use in decorations. It tells how to recognize the plants and how they are used in the decorative trade.

Northeastern Forest Experiment Station.
1970. **The silviculture of oaks and associated species.** USDA Forest Serv. Res. Paper NE-144, 66 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
A symposium report summarizing present knowledge about the effects of density, thinning, and composition on the growth and yield of eastern hardwood forests—upland oaks, bottomland hardwoods, yellow-poplar, sweetgum, and black walnut. Emphasis on recent research literature.

Safford, L. O.
1970. **Dry weight and nutrient content of red spruce needles influenced by urea fertilization and soil type.** (Abstr.) **In** First N. Amer. Forest Biol. Workshop. Mich. State Univ., East Lansing.
Single, mature, dominant red spruce (**picea rubens** Sarg.) trees growing in natural stands on three soils were treated with N. Dry weight per needle and content of N, P, K, Ca, Mg, Fe, Mn, Zn, B, Cu, Mo, and Al were measured. No response in bole wood production has been measured. Soil type did not influence response to fertilization.

Schreiner, Ernst J.
1969. **Tree breeding in the United States forestry practice.** FAO and IUFRO Second World Consult. on Forest Tree Breeding Doc. FO-FTB-69-14/1. 29 pp.
This report highlights the expansion and achievements of tree breeding in the United States forestry practice and research since 1936. It is also available in French and Spanish versions.

Schreiner, Ernst J.
1969. **La reproduction des arbres dans la pratique de la sylviculture aux Etats-Unis.** FAO-IUFRO Second World Consult. on Forest Tree Breeding. Doc. FO-FTB-69-14/1. 29 pp.
French edition of the above.

Schreiner, Ernst J.
1969. **Practicas de mejoramiento de especies forestales. in Estados Unidos.** FAO-IUFRO Second World Consult. on Forest Tree Breeding Doc. FO-FTB-69-14/1. 28 pp.
Spanish edition of the above.

Schreiner, Ernst J.
1970. **Mini-rotation forestry.** USDA Forest Serv. Res. Paper NE-174, 32 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The author predicts that the Fifth Forest of the Northeast will have to be managed intensively—established, cultured, and harvested by machine—on rotations as short as 2 to 5 years for fiber production, 5 to 15 years for boltwood, and 15 to 30 years for timber or veneer-wood production. Possibilities and implications of mini-rotation are outlined, and some species and hybrids are suggested that could be used immediately for trial of short-rotation management.

Schreiner, E. J.

1970. **Tree breeding in United States forestry practice.** Unasylva 24 (97-98): 96-108, illus.

This report highlights the expansion, direction, and achievements of tree breeding in United States forestry practice and research since 1936. Also available in the French and Spanish editions of Unasylva 24(97-98).

Smith, H. Clay, and Carter B. Gibbs.

1970. **A guide to sugarbush stocking based on the crown diameter/d.b.h. relationship of open-grown sugar maples.** USDA Forest Serv. Res. Paper NE-171, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A stocking guide for the management of sugarbushes has been developed, based on the relationship between crown diameter and diameter at breast height (d.b.h.) of open-grown trees. The guide suggests the number of trees and the residual basal area per acre for sugarbush stands of various d.b.h. classes. It is designed for undeveloped forest-grown stands, overcrowded sugarbushes, and plantations.

Smith, H. Clay, and Carter B. Gibbs.

1970. **Are pellets necessary with vacuum-pumping?** Nat. Maple Syrup Dig. 9(3): 14-15, illus.

Researchers collected 17 percent more sap from sugar maple trees without using pellets than from the trees in which pellets were used. These results indicate that, when a 12-inch vacuum is used, the paraformaldehyde pellet is not necessary.

Smith, M. Clay, and Carter B. Gibbs.

1970. **Comparison of vacuum and gravity sap flows from paired sugar maple trees.** USDA Forest Serv. Res. Note NE-122, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Paired sugar maple trees with single tapholes were used to compare sap yields from vacuum-pumping with sap yields from gravity flow. Results indicated that vacuum yields were about twice as great as gravity flows. These results support previous findings from studies in which vacuum and gravity were compared with two tapholes on the same tree.

Smith, H. Clay, and Arthur H. Rye.

1970. **Measure that vacuum.** Nat. Maple Syrup Dig. 9(2): 12-13, illus.

For vacuum pumping to increase sugar maple sap yields, there

must be a vacuum at the taphole. This article discusses how to use vacuum gauges to make sure the vacuum is adequate at the taphole.

Smith, H. Clay, and George R. Trimble, Jr.

1970. **Mistblowing a hardwood understory in West Virginia with "D-T" herbicide.** USDA Forest Serv. Res. Note NE-115, 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A 40-pound ahg. solution of 2, 4-D and 2, 4, 5-T herbicide was successfully mistblown on an undesirable hardwood understory on a good site in West Virginia. After 2 years, many of the stems 1 to 15 feet tall had been killed or severely damaged. The possibilities of obtaining desirable shade-intolerant reproduction on the site were improved by the application of this "D-T" herbicide backpack mistblowing treatment.

Smith, H. Clay, and Carter B. Gibbs.

1970. **Paraformaldehyde pellet not necessary in vacuum-pumped maple sap system.** USDA Forest Serv. Res. Note NE-118, 4 pp, illus. NE. Forest Exp. Sta., Upper Darby, Pa.

In a study of sugar maple sap collection through a vacuum-pumped plastic tubing system, yields were compared between tapholes in which paraformaldehyde pellets were used and tapholes without pellets. Use of the pellets did not increase yield.

Smith, H. Clay, E. Bradford Walker, Alex L. Shigo, and Frederick M. Laing.

1970. **Results of recent research on the pellet.** Nat. Maple Syrup Dig. 9(4): 18-21, illus.

Use of paraformaldehyde pellets to increase sap flow may cause damage to the sap-producing tissues of sugar maple trees. Whether the damage is so severe that pellets should not be used is unknown, and more research on this is recommended.

Snow, Albert G., Jr.

1970. **Maple sugaring in Connecticut for profit and pleasure.** Nat. Maple Syrup Dig. 9(1): 16-18.

Maple syrup production is gradually increasing in Connecticut. In addition to at least 20 commercial producers, over 50 others make enough maple syrup for their own needs, and a few of their friends and neighbors. A much greater sugar maple resource is available than is being used.

Trimble, George R., Jr.

1970. **20 years of intensive uneven-aged management.** USDA Forest Serv. Res. Paper NE-154, 12 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A 20-year study was made of two 31-acre hardwood stands in West Virginia that were cut periodically under an individual tree-selection system. Under this system of cutting, species composition is changing from a preponderance of cove hard-

woods (yellow-poplar, black cherry, red oak, etc.) to red and sugar maple, sweet birch, and beech.

Trimble, George R., Jr., and Donald W. Seegrist.
1970. **Distribution of diameter growth rates & clear stem lengths as a basis for selecting superior phenotypes.** USDA Forest Serv. Res. Paper NE-160, 11 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Using actual data on d.b.h. growth rates and length of clear stem for northern red oak, the authors propose a method of selecting plus trees to be used in a tree-breeding program. This method is based on the distribution in natural tree populations of certain features of interest. When an estimate of these distributions is available, acceptance of candidate trees can be set at any desired percentile.

Trimble, G. R., Jr., and H. Clay Smith.
1970. **Sprouting of dormant buds on border trees.** USDA Forest Serv. Res. Paper NE-179, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study of dormant-bud sprouting was made on codominant, middle-aged red oak and yellow-poplar trees released on one side by patch cutting. Comparisons are made between species, between bole faces, and between first and second logs.

Tryon, E. H., and G. R. Trimble, Jr.
1970. **Effect of distance from stand border on height of hardwood reproduction in openings.** W. Va. Acad. Sci. Proc. 41: 125-132, illus.

A study was made to determine the influence of size of reproduction openings cut in hardwood stands on the height growth of established reproduction. The results indicated that the surrounding stand had little or no effect on height growth of the reproduction unless the plots were as small as $\frac{1}{4}$ acre. This held true even for intolerant species.

Waters, Russell S.
1970. **Shaping Christmas trees with chemicals.** Amer. Christmas Tree J. 14(2): 23-26, illus.

Chemicals have been used successfully to prune ornamental plants. A study was made to see how well chemical pruning would work on Scotch pine. Although the results of the experiments were generally negative, further research of chemicals and their use may eventually make chemical pruning of Christmas trees a reality.

Webb, Charles D.
1970. **Genetics and tree improvement in the oak—yellow-poplar type.** In **the silviculture of oaks and associated species.** USDA Forest Serv. Res. Paper NE-144: 57-66, illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A discussion of what is known about genetic variation within the species of the oak—yellow-poplar type and how much im-

provement can be expected from selection, breeding, and intensive silviculture, including a list of references.

Van Buijtenen, J. P.
1969. **Controlling wood properties by forest management.** TAPPI 52(2): 257-259.
Forestry operations were analyzed in terms of their effect on wood quality. Major factors are choice of site and species, genetic improvement, silvicultural practices, modern harvesting methods, and pulpwood storage. Through these factors a great deal of control can be exercised over the quality of raw material that reaches the pulp mill. Greatest opportunities to produce more uniform pulpwood that meets specific quality standards exist in utilizing particular portions of the stem for specific products; developing varieties of trees capable of responding to intensive management; and developing management practices capable of utilizing the full potential of these improved varieties.

Yawney, Harry W., and Clayton M. Carl, Jr.
1970. **A sugar planting study in Vermont.** USDA Forest Serv. Res. Paper NE-175, 14 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
2-0 sugar maple seedlings were fall outplanted to evaluate several methods of weed-control and seedling protection. A combination of cultivation (plowing and disking) and black plastic mulch provided excellent weed control for as long as 4 years and significantly increased growth over other cultural treatments. The protective treatments (a repellent and wire screens) were not completely effective, so the full potential of the cultural treatments was masked by deer browsing.

FOREST ECONOMICS

Bones, James T., and James E. Blyth.
1970. **Hardwood veneer log production and receipts for 1968.** N. Logger 18(1): 34.
A 1968 study showed that veneer log production has risen slightly since 1963 in the Eastern, Central, and Lake States regions. In the 21-state study area, the Middle Atlantic States showed the greatest production surplus: veneer log requirements were only 64 percent of the total volume produced.

Bones, James T., and David R. Dickson.
1970. **Pulpwood production in the Northeast—1969.** USDA Forest Serv. Resource Bull. NE-22, 34 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
An annual report based upon canvasses of pulpwood production in the Northeast, containing data about pulpwood production from roundwood in the 14 Northeastern States by counties and species groups, and pulpwood chip production

from plant residues. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 7 years are shown for the Northeast.

Bones, James T., and David R. Dickson.
1970. **The veneer industry in the Northeast.** USDA Forest Serv. Resource Bull. NE-21, 17 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results of a survey of veneer producers in the Northeast in 1968: veneer-log production and receipts by states and species, log shipments between states and regions, and relationship of timber supply to log production. Comparisons are made with a similar canvass made in 1963. A current list of active veneer plants is included.

Ferguson, Roland H., and Carl E. Mayer.
1970. **The timber resources of New York.** USDA Forest Serv. Resource Bull. NE-20, 193 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

This report on a resurvey 18 years after the initial survey includes findings on forest-land area, timber volume, annual growth, timber removal, timber products output, employment, and value added by timber-related industries. It includes 90 tables of data for the state, geographic units, and counties.

Kingsley, Neal P., and Carl E. Mayer.
1970. **The timber resources of Ohio.** USDA Forest Serv. Resource Bull. NE-19, 137 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A report on the second forest survey of Ohio 16 years after the initial forest survey made by the USDA Forest Service. The report presents statistical findings on forest land area, timber volume, net annual growth, and timber removal; and describes changes and trends in the timber resource. The report also contains a discussion of the timber-supply outlook and points out opportunities for timber management. Detailed statistical data are contained in 70 tables.

Manthy, Robert S.
1970. **An investment guide for cooperative forest management in Pennsylvania.** USDA Forest Serv. Res. Paper NE-156, 59 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A guide for CFM program administrators in identifying the profitability of program activities aimed at timber production. The public, private, and total costs of establishing sponsored planting and TSI (timber stand improvement) activities and the costs of providing harvesting and marketing assistance are given. Interest rates of return to investments in planting and TSI practices are calculated.

Mendel, Joseph J., and William H. Smith.
1970. **Quality index tables for some eastern hardwood**

species. USDA Forest Serv. Res. Paper NE-167, 24 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Log-quality indexes based on 1964-68 lumber price reports for three regions and Forest Products Laboratory lumber grade yields are presented for white ash, beech, black cherry, hard maple, red oak, soft maple, white oak, yellow-poplar, and birch. Methods are given for evaluating sawtimber logs in the sawmill yard and in the standing tree by using the log-quality index

Worley, David P.

1970. **The "Let-it-grow" treatment for timber—is it economically worthwhile?** USDA Forest Serv. Res. Paper NE-157, 37 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A short-run (10-year) economic evaluation of the "let-it-grow" management alternative was made for fully stocked hardwood stands of selected ages growing on different sites in the presence of different wood-product markets. Evaluation variables included physical product increases, value-per-acre increases, and rates of return on the timber investment.

FOREST PRODUCTS MARKETING & UTILIZATION

Adams, E. L.

1970. **How much can you afford to pay for hardwood logs? SOLVE will tell you.** N. Logger 19(3): 18, 19, 39.

The computer program SOLVE can help hardwood sawmill operators determine the maximum values that they can afford to pay for their delivered sawlogs. In determining these log values, the program takes into account the operators' individual cost and price situation.

Bond, Robert S., and Paul E. Sendak.

1970. **The structure of the wood platform industry of the Northeast.** Univ. Mass. Exp. Sta. Bull. 586. 70 pp. Amherst.

The wood-platform industry will need to make changes in its present organization to continue to be competitive. Some suggestions are made toward that end.

Brisbin, Robert L.

1970. **Eastern hemlock** (Tsuga canadensis **(L.) Carr.).** USDA Forest Serv. Amer. Woods Ser. FS-239. 8 pp., illus.

A description of the distribution, growth habits, related species, supply and production, properties, and uses of eastern hemlock.

Church, Thomas W., Jr.
1970. **Applalachian loggers: take the better roads for quicker trips.** S. Lumberman 221(2752): 109-112, illus.
Data on average operating speeds for empty and loaded trucks on different types of Appalachian roads, showing proportional distribution of speeds by road type. Loggers should consider alternative routes, because elapsed travel time may be less on long routes with good roads than on short routes with poor roads. The author describes a procedure for estimating travel time and lists advantages of using the quickest routes.

Church, Thomas W., Jr., and Lawrence D. Garrett.
1970. **Should a hardwood lumber producer saw ties and timber too?** N. Logger 18(10): 16, 18, 20-22, 54, illus.
Sawmill operators can often increase their net profits by sawing the hearts of factory-grade logs into timbers rather than lumber. The decision to saw timbers must be based upon the number of logs that will be physically good enough and the amount of extra income expected. If timbers are cut from the heart sections of low-grade logs, the additional profit may range up to $2 each.

Craft, E. Paul.
1970. **Construction-grade plywood from Grade 3 Appalachian oak.** USDA Forest Serv. Res. Paper NE-163, 30 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
A sample of factory grade 3 oak was processed in a typical southern pine sheathing plant, and the production costs and break-even prices for the plywood products were determined. The machinery and plant process used for southern pine plywood production were readily adaptable to oak plywood production, and the yield of hardwood veneer made the plywood product competitive with softwood plywood.

Garrett, Lawrence D.
1970. **Physical suitability of Appalachian hardwood sawlogs for sawed timbers.** USDA Forest Serv. Res. Note NE-121, 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
A study of the physical suitability of Appalachian hardwood sawlogs for manufacture of sawed timbers revealed that: most grade 1 logs can be used to saw timbers as large as 8 by 9 inches, end dimension; most grade 2 logs are suited for manufacture of timbers 6 by 8 inches and smaller; and most grade 3 logs are suited for manufacture of timbers 5 by 7 inches and smaller.

Goho, Curtis D., and Paul S. Wysor.
1970. **Characteristics of factory-grade hardwood logs delivered to Appalachian sawmills.** USDA Forest Serv.

Res. Paper NE-166, 17 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A graphic description of the diameter, length, and volume of factory-grade hardwood sawlogs delivered to Appalachian sawmills. Log-grade frequencies are tabulated by species and diameter class, and median log volumes are given.

Hansen, Bruce G., and B. J. Warder.

1970. **The West Virginia sawmill industry—1967.** W. Va. Dep. Natur. Resources. 53 pp., illus.

A study of the sawmill industry in West Virginia sheds light on such things as the types of operation, equipment, employment, and production as well as on fluctuations in the industry in recent years.

Knutson, Robert.

1970. **A look at the mine-timber market in the Appalachian bituminous coal region.** USDA Forest Serv. Res. Paper NE-147, 9 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The tonnage of coal produced from underground mines is expected to increase in future years, so volume of wood used in coal mining is also expected to increase. Sawmill operators are advised to consider this market as a potiential outlet for their products. Information on favored species for mine timbers and data on the quantity of wood now used are included.

Martens, David G., and Neil K. Huyler.

1970. **Length and width distribution of 4/4 Appalachian hard maple lumber.** S. Lumberman 221(2751): 19-20.

Of the nearly 200 possible combinations of lengths and widths of hard maple lumber, less than a fifth are produced with any degree of regularity. Over 75 percent of the volume was found to occur in boards of only five lengths and five widths. However, differences in length and width distribution were found between the various grades.

Martens, David G., and Leonard J. Koenick.

1970. **Use of hardwood flooring in mobile homes.** USDA Forest Serv. Res. Paper NE-172, 10 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Though the mobile-home industry has captured a large part of the U. S. housing market, this industry uses very little hardwood flooring. Installation speed appears to be the most critical factor in limiting the use of hardwood strip flooring in mobile homes. Weight, thickness, strength, flexibility, dimensional stability, and repairability are of only minor importance.

McCauley, Orris D., and John C. Redman.

1970. **Lumber specifications of the wood-using industries in Kentucky and surrounding states.** Univ. Ky. Agr. Econ. Ext. Inf. Ser. 4, 10 pp., illus.

A study of 582 active wood manufacturing firms in Kentucky and surrounding States was made to provide lumber producers

in that area with knowledge about the species, grade, and lumber condition requirements of lumber-using markets.

Nolley, Jean W.
1970. **Christmas tree marketing: a bibliography.** Amer. Christmas Tree J. 14(2): 27-31.
An annotated bibliography of recently published information from 22 major publications about the Christmas tree industry, production, management practices, silviculture, marketing, and consumption.

Pendleton, Thomas H., and Lawrence D. Garrett.
1970. **Report on a strong substitute—the artificial Christmas tree.** Amer. Christmas Tree J. 14(2): 3-5, illus.
The artificial Christmas tree industry has been successful in capturing a large share of the household, nonhousehold, and institutional markets that once belonged to the natural tree industry. Studies have indicated that economy, convenience, and appearance—plus the fact that they are nonflammable—account for the popularity of artificial trees. The next 5 years will bring a gradual increase in sales, as well as many innovations in this industry.

Pendleton, Thomas H., and Lawrence D. Garrett.
1970. **Factors that influence Christmas tree sales.** USDA Forest Serv. Res. Note NE-112, 5 pp. NE. Forest Exp. Sta., Upper Darby, Pa.
An analysis of the metropolitan Christmas tree market in Winston-Salem, N. C., showed that, to sell more trees, Christmas tree retailers should locate their lots on heavily traveled streets in business areas, have adequate parking facilities, advertise, and have attractive displays of trees. Retailers who follow these practices can expect to receive higher prices for their trees.

Reynolds, Hugh W.
1970. **Sawmill simulation: data instructions and computer programs.** USDA Forest Serv. Res. Paper NE-152, 41 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Instructions and computer programs for computer program DEFECT to simulate sawing logs into boards. Log samples are sawed, and the type and location of all defects are encoded into the computer. The logs are in effect reassembled within the computer and can be sawed repeatedly with different sawing patterns. The program shows how defects appear on each new board for each new sawing pattern. The instructions include how to use computer program YIELD to simulate the ripping and trimming of boards generated by program DEFECT.

Reynolds, Hugh W., and Charles J. Gatchell.
1970. **The SHOLO mill: Make pallet parts and pulp chips from low-grade hardwoods.** USDA Forest Serv. Res. Paper NE-180, 16 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The SHOLO (from SHOrt LOg) process is used to produce pulp chips and pallet parts from low-grade hardwood. Long logs are bucked to short logs of predetermined lengths and quality and the round residue remaining is converted into pulp chips. A detailed description of the SHOLO process is given. An example is given of the costs and production of a SHOLO mill.

Schmidt, J. W., Jr., W. D. Torlone, J. Bird, and M. R. Fedorko.
1970. **Feasibility study on the retrieval and use of primary wood residue.** W. Va. Univ. Eng. Exp. Sta. Rep. 11. 250 pp. Morgantown, W. Va.

A study to determine the feasibility of harvesting small limbs and cull wood usually left in the forest after logging. Cutting-practice data were acquired for the Allegheny, Monongahela, and George Washington National Forests. Residue per tree is given for a small sample. A simulation model is developed and presented for a system of harvesting the residue material.

Sonderman, David L.
1970. **Balsam fir** (Abies balsamea). USDA Forest Serv. Amer. Woods Ser. FS-234. 8 pp., illus.

A description of the distribution, growth habits, related species, supply and production, properties, and uses of balsam fir.

Stern, E. George.
1970. **Rigidity of nailed 48" x 40" plywood-deck pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 90: 12 pp., illus.

A plywood-deck pallet, constructed of four pieces of ½-inch plywood, was tested in the laboratory. It compares favorably with pallets employing a one-piece deck. This type of structure allows more efficient use of scrap plywood.

Stern, E. George, and William C. Miller.
1970. **Smaller tongue for strip flooring.** Va. Polytech. Inst. Res. & Wood Constr. Lab. Misc. Bull. 89. 12 pp., illus.

Strength comparisons were made between standard tongue-and-groove strip flooring and a similar product with a 1/16-inch narrower tongue. The narrow tongue may reduce the load-carrying capacity of the flooring strip slightly, but not enough to cause problems in residential construction even if the flooring is laid directly on joists without subflooring.

Stern, E. George, and William C. Miller.
1970. **Smaller tongue for strip flooring.** Flooring Mag. 76(8): 61-63, illus.

Shortened version of the above.

Strobel, John J., and Walter B. Wallin.
1970. **The status of frozen food distribution today and where opportunities lie for economies.** Frozen Food Age 18(12): 44-48, 51-55.

Frozen foods comprise about 5 percent of total food shipments.

Relative to the dry-groceries industry, a very small proportion of frozen foods is palletized. Case sizes are smaller than those of dry groceries, case weights are half those of dry groceries, and purchase orders are smaller. About 40 percent of the volume could be palletized.

Timson, Floyd G.

1970. **Hardwood log weighing and its potential use.** N. Logger 19(2): 24-25, 66-67.

The status of research on the development of weight tables for hardwood logs is discussed. Variation in log weights and variation between actual and estimated truckload weights are reported. The advantages of scaling by weight are discussed.

Wolf, Charles H.

1970. **Wood industry location decisions: A study of plant location procedures and the need for a data bank in West Virginia.** W. Va. Univ. Bull. 70(11-4): 96 pp.

Interviews with wood-using firms that had recently established new plants in West Virginia, Pennsylvania, and Kentucky were used to examine timber and forest land as factors in location decisions. Interviews were held with government officials in several states to study forest industry development programs and computerized plantsite selection systems.

Wolf, Charles H., and Gilbert P. Dempsey.

1970. **Plant location: by choice or chance?** S. Lumberman 221(2752): 157, 160-162, illus.

Various techniques are used for selecting plant sites. Knowledge of these techniques and of where to seek assistance should prove particularly useful to small firms that wish to expand, but have limited resources available for investigation work.

FOREST INSECTS

Barger, Jack H.

1970. **Field and laboratory evaluation of methoxychlor for Dutch elm disease vector control.** (Abstr.) Entomol. Soc. Amer. Miami Beach Meeting, Abstr.: 50.

Mistblower and helicopter applications of methoxychlor were made on elm trees in Milwaukee, Wisconsin. Bioassays show residues persisted longer than 1 year. Mistblower coverage was better than helicopter. Disease incidence varied among experimental plots during 1969 and 1970.

Burns, Denver P.

1970. **Insect enemies of yellow-poplar.** USDA Forest Serv. Res. Paper NE-159, 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Yellow-poplar is attacked by four species of insects that seriously damage or kill trees: the tuliptree scale, the yellow-poplar

weevil, the root collar borer, and the Columbian timber beetle. Damage characteristics and life cycle are discussed for each pest. Other insects commonly associated with yellow-poplar but generally considered to be minor pests are discussed briefly.

Burns, Denver P., and David E. Donley.
1970. **Biology of the tuliptree scale,** Toumeyella liriodendri **(Homoptera: Coccidae).** Ann. Entomol. Soc. Amer. 63: 228-235, illus.

By sucking sap from the tree, the scale insects can kill the tree, seriously deform it, or reduce its vigor. The authors described the life cycle of the insect and the biotic organisms that normally control it. Ants, which collect the honeydew secreted by the scale, serve to protect the scale from its natural enemies.

Cannon, William N., Jr.
1970. **A disposable insulated container for rearing fall webworm larvae in the laboratory.** USDA Forest Serv. Res. Note NE-123, 3 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Plastic-foam cups with plastic lids were found to be more suitable for rearing larvae of the fall webworm, **Hyphantria cunea** Drury, than other types of containers tested. These cups are inexpensive, lightweight, rigid, and translucent; and they protect the contents from rapid fluctuations in temperature.

Cannon, William N., Jr.
1970. **Distribution records of the locust leaf miner,** Odontota dorsalis **(Thun.), in the United States.** Entomol. News 81: 115-120.

Records and reports of the distribution of the locust leaf miner, **Odontota dorsalis,** in the United States have been assembled in this paper.

Cuthbert, Roy A., A. Charles Lincoln, Bruce H. Kennedy, and Nick H. Roberto.
1970. **Laboratory assay of** Scolytus multistriatus **and** Dendrosoter protuberans **on DDT and Methoxychlor.** J. Econ. Entomol. 63: 1889-1891.

Responses to DDT and methoxychlor by the smaller European elm bark beetle, **Scolytus multistriatus** (Marsham), and an imported hymenopterous parasite of the beetle were measured in laboratory assays. Both species were tested with a series of concentrations of each insecticide. There were no significant differences in the responses between species at the 95-percent confidence level, but there were significant differences between insecticides.

Doskotch, Raymond W., Sujit K. Chatterji, and John W. Peacock.
1970. **Elm bark derived feeding stimulants for the smaller European elm bark beetle.** Science 167: 380-382.

The principal feeding stimulants for the beetle **Scolytus multistriatus** Marsham have been identified from the twig bark of

Ulmus americana L. as (+)-catechin-5-B-D-xylopyranoside and lupeyl cerotate.

Gibson, Lester P.
1969. **A review of the insects affecting oak acorns and the types of damage incurred.** (Abstr.) Entomol. Soc. Amer. N. Central Br. Proc. 24(1): 39.
An abstract of an illustrated talk given at the North Central Branch meeting of the Entomological Society of America. It covered the known spectrum of insect damage to acorns.

Gibson, Lester P.
1969. **Monograph of the genus** Curculio **in the new world (Coleoptera: Curculionidae). Part I. United States and Canada.** Entomol. Soc. Amer. Misc. Pub. 6(5): 241-285.
Detailed morphological and taxonomic characteristics of the genus **Curculio** L. are presented for those 27 species known to occur in the United States and Canada. Included are keys, known distributions, a brief biology, remarks about all species and synonyms, maps of host and species ranges, drawings, and listings of type locations. A neotype and six neoparatypes have been designated for **C. nasicus** (Say).

Kennedy, Bruce H.
1970. Dendrosoter protuberans **(Hymenoptera: Braconidae) an introduced larval parasite of** Scolytus multistriatus. Ann. Entomol. Soc. Amer. 63: 351-358, illus.
Dendrosoter protuberans (Nees) is easily reared in the laboratory, oviposits through the bark onto larvae of the smaller European elm bark beetle, can overwinter in the central U. S., and reproduces itself under field conditions.

Kennedy, Bruce H.
1970. **A device for separating and holding small photopositive insects.** J. Econ. Entomol. 63: 1697-1698, illus.
A bottle, a plastic ball, and gelatin capsules can be used to make a device for separating and holding photopositive insects without use of an anesthetic.

Peacock, J. W., A. C. Lincoln, J. B. Simeone, and R. M. Silverstein.
1970. **Field attraction of** Scolytus multistriatus **(Coleoptera: Scolytidae) to a virgin-female-produced pheromone.** (Abstr.) Entomol. Soc. Amer. Miami Beach Meeting Abstr.: 51.
Field studies on breeding-site selection by the smaller European elm bark beetle indicate that flying male and female beetles apparently respond to a pheromone produced by virgin females boring in suitable host material. Laboratory data suggest that the pheromone is contained in virgin-female frass.

Peacock, John W., and Frank W. Fisk.
1970. **Phagostimulants for larvae of the mimosa webworm,**

Homadaula anisocentra. Ann. Entomol. Soc. Amer. 63: 1755-1762, illus.

The chemical constituents of honey locust leaves were investigated as feeding stimulants for larvae of **Homadaula anisocentra** Meyrick. A water-soluble fraction evoked a significant feeding response. Several sugars and amino acids were present in this extract, but only sucrose and fructose stimulated feeding significantly; several amino acids stimulated feeding to a lesser degree. The presence of other active water-soluble constituents is probable, but none was isolated during this study. A chloroform-soluble fraction from the leaves apparently synergized the activity of sugars and other water-soluble constituents but was relatively inactive itself.

Peckham, David J.

1969. **A serological comparison of** Pissodes strobi **and** P. approximatus. Can. Entomol. 101(1): 78-90, illus.

The serological relationships of **Pissodes strobi** and **P. approximatus** were examined, using turbidimetric and immunodiffusion analyses.

Rexrode, Charles O., and Thomas W. Jones.

1970. **Oak bark beetles—important vectors of oak wilt.** J. Forestry 68: 294-297, illus.

Evidence is accumulating that oak bark beetles, **Pseudopityophthorus** ssp., are important vectors of the oak wilt fungus, **Ceratocystis fagacearum.** They make breeding attacks on nearly all wilt-infected trees, often in large numbers. They feed readily on healthy oaks, making wounds that are ideal infection courts for the fungus.

Rollinson, W. D., H. B. Hubbard, Jr., and F. B. Lewis.

1970. **Mass rearing of the European pine sawfly for production of the nuclear polyhedrosis virus.** J. Econ. Entomol. 63: 343-344, illus.

In the spring of 1967 and 1968, mass rearings of the European pine sawfly **Neodiprion sertifer** (Geoffroy) were carred out for the production of large amounts of its polyhedrosis virus. Larvae were infected with the nuclear polyhedrosis virus by feeding on virus-sprayed foliage. This note details procedures of the rearings and virus production.

Talerico, Robert L., and Roger C. Chapman.

1970. **Sequan: A computer program for sequential analysis.** USDA Forest Serv. Res. Note NE-116, 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A description of a FORTRAN IV computer program for performing sequential analysis on four common distributions after the underlying probability distribution is known.

Wollerman, E. H.

1970. **The locust borer.** USDA Forest Pest Leafl. 71 (revised 1970).

A description of the locust borer, its range, the damage it

causes, factors that affect its activity, and protective measures against it.

FOREST DISEASES

Berry, Frederick H.
1970. **Walnut anthracnose.** USDA Forest Serv. Forest Pest Leafl. 85 (Rev.) 4 pp., illus.
Walnut anthracnose or leaf blotch, caused by a fungus (**Gnomonia leptosyla**), is destructive to black walnut (**Juglans nigra**) throughout its range. This leaflet describes symptoms and life history of the fungus. No practical method of control is known.

Cosenza, Benjamin J., Mathilda McCreary, John D. Buck, and Alex L. Shigo.
1970. **Bacteria associated with discolored and decayed tissues in beech, birch, and maple.** Phytopathology 69: 1547-1551, illus.
Bacteria isolated from discolored and decayed tissues in beech, birch, and maple trees from New Hampshire were identified and characterized. Species of **Bacillus** and **Pseudomonas** were the most common among the 326 isolates examined. Members of the family Enterobacteriaceae, yellow-pigmented gram-negative rods, coryneforms, and yeasts accounted for the remainder.

Dochinger, Leon S.
1970. **Air pollution and lanscape plants.** Nat. Landscape Assoc. Tech. Notes. L 10 Dec.: 1-5.
Trees and shrubs are listed according to their susceptibility or tolerance to various air pollutants.

Dochinger, Leon S.
1970. **The impact of air pollution on Christmas tree plantings.** Amer. Christmas Tree J. 14(3): 5-8, illus.
Public education and support are necessary to halt the contamination of our atmosphere. Unless a personal involvement is immediately effected, we must expect an intensification in acute and chronic air pollution in Christmas tree plants.

Dochinger, L. S.
1970. **The impact of air pollution on eastern white pine. the chlorotic dwarf disease.** (Abstr.) Dok. Reinhaltung der Luft 1 (5): 210.
Chlorotic dwarf, a foliar disturbance, was found to be due to air pollution. Cross-grafting between diseased and health trees demonstrated that susceptibility is an inherited genetic characteristic.

Dochinger, L. S., F. W. Bender, F. L. Fox, and W. W. Heck.
1970. **Chlorotic dwarf of eastern white pine caused by an**

ozone and sulphur dioxide interaction. Nature 225 (5231): 476.

A study of chlorotic dwarf disease of eastern white pine (**Pinus strobus** L.) indicated the disease is caused by gaseous pollutants that injure the needles of genetically susceptible trees. Two pollutants, ozone and sulfur dioxide, acting independently or together, caused characteristic symptoms associated with the chlorotic dwarf syndrome.

Dochinger, Leon S., and Carl E. Seliskar.

1970. **Air pollution and the chlorotic dwarf disease of eastern white pine.** Forest Sci. 16: 46-55, illus.

Chlorotic dwarf is a serious disorder of eastern white pine (**Pinus strobus** L.) in young plantations. Diseased trees are stunted, with mottled foliage, and have only the current-year needles. In a series of experiments in which chambers were erected around living trees to regulate airflow and filter out pollutants, it was found that dispersoid pollutants, through their harmful effect on foliage of genetically susceptible white pines, are responsible for chlorotic dwarf. Ambient levels of ozone and sulfur dioxide, singly and in combination, promoted early symptoms of premature defoliation and needle mottling on susceptible ramets in fumigation chambers.

Gregory, Garold F., and Carl E. Seliskar.

1970. **A virus-like disorder of overcup oak.** USDA Plant Dis. Rep. 54: 844-846.

Overcup oak (**Quercus lyrata**) seedlings were stunted and developed mottled, misshapen, leathery, chlorotic leaves and active buds in leaf axils. Although these symptoms were characteristic of virus, no evidence of a virus causal agent was found.

Houston, David R.

1970. **Comparison of infrared color and true-color aerial photography for studying beech bark disease.** Aerial Color Photogr. in the Plant Sci. Workshop Proc.: 76-77. Gainesville, Fla.

Several forest stands in Vermont where beech is being attacked and killed were photographed, providing a 3-year record on true color (Kodak SO-282) and Ektachrome infrared (type 8443) films of changes in crown conditions. Foliar symptoms were detected readily on both films. Detection of species was enhanced by infrared film.

Jones, Thomas W.

1970. **What about hardwood diseases?** Fifth Forest Insect & Dis. Work Conf. Proc.: 201-208.

The major hardwood disease problems of the eastern United States are reviewed and evaluated.

Lincoln, A. Charles.

1969. **The Dutch elm disease research program in the U. S.**

Forest Service. Tree Wardens, Arborists, and Utilities Conf. Proc.: 138-147.

Dutch elm disease research is one of five major shade tree problems singled out for intensive study. The direct concern is to reduce the numbers of the vector by: (1) increasing the effectiveness of insecticides while reducing the hazards inherent in their use; and (2) developing alternate or supplemental control methods, such as the imported European parasite, **Dendrosoter protuberans.**

Parker, J.

1970. **Heat effects on survival, respiration, and ultrastructure in tree twigs.** (Abstr.) Plant Physiol. 46 (Suppl.): 22.

Severed twigs or leaves of deciduous and evergreen trees were subjected to heat by water immersion. The effects of heat on survival, respiration, and ultrastructure were studied.

Parker, Johnson.

1970. **Effects of defoliation and drought on root food reserves in sugar maple seedlings.** USDA Forest Serv. Res. Paper NE-169, 8 pp. illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Root food reserves and starch levels in defoliated sugar maple seedlings were lower than in undefoliated controls. Unwatered seedlings did not have significantly lower root food reserves than watered controls. Starch levels were lower and glucose and fructose levels were higher in unwatered seedlings than in controls.

Parker, Johnson.

1969. **Further studies of drought resistance in woody plants.** The Bot. Rev. 35(4): 317-371.

This publication brings a 1956 review of drought resistance up to mid-1968 and includes a number of new topics. The role that droughts play in the initiation of tree diseases is considered, especially in the light of new evidence from studies of dieback and decline of forest trees. Interactions between soil moisture and transpiration are discussed as well as ways to control transpiration in large stands.

Roberts, Bruce R., and Keith F. Jensen.

1970. **The influence of Dutch elm disease and plant water stress on the foliar nutrient content of American and Siberian elm.** Phytopathology 60: 1831-1833, illus.

Two-year-old seedlings of American elm and Siberian elm were inoculated with **Ceratocystis ulmi** or subjected to plant water stress by withholding water. Nutrient analyses made on the foliage of all seedlings at the end of the experiment showed a significant difference in phosphorus and nitrogen content between species, but no difference in calcium or potassium.

Roberts, Bruce R., and Keith F. Jensen.

1970. **The influence of Dutch elm disease and plant water stress on the foliar nutrient content of American and**

Siberian elm. (Abstr.) **In** First N. Amer. Forest Biol. Workshop. Mich. State Univ., East Lansing.

Abstract of study results reported above.

Shigo, Alex L.

1970. **Beech bark disease.** USDA Forest Pest Leafl. 75 (revised). 8 pp., illus.

A discussion of beech bark disease including history and distribution, causes, symptoms, and a selected list of references.

Shigo, Alex L.

1970. **Growth of** Polyporus glomeratus, Poria oblique, Fomes igniarius, **and** Pholiota squarrosa-adiposa **in media amended with manganese, calcium, zinc, and iron.** Mycologia 62: 604-607, illus.

Results suggest that concentrations of different minerals in the altered dead and discolored wood surrounding the Hymenomycetes in living trees could enhance or inhibit their growth, and thus greatly affect the rate of decay. The severe inhibition of growth of **P. glomeratus** by light should be investigated further.

Shigo, Alex L.

1970. **An expanded concept of decay in living trees.** In **Interaction of organisms in the process of decay of forest trees.** Laval Univ. Forest Res. Found. Bull. 15: 7-9.

The introduction to a symposium sponsored by the Canadian Phytopathological Society, in which the author points out some of the questions that must be considered as a new concept develops about the processes of decay and discoloration in living trees.

Shigo, Alex L., and Frederick M. Laing.

1970. **Some effects of paraformaldehyde on wood surrounding tapholes in sugar maple trees.** USDA Forest Serv. Res. Paper NE-161, 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Paraformaldehyde increases yield of sap in sugar maple trees. It does this not only by inhibiting the growth of microorganisms in the taphole, but by killing tissues that surround the taphole. Vessel plugs do not form in the dead tissues. In a sense, a larger hole is made in the tree. Wood-inhabiting microorganisms rapidly invade the killed tissues, and decay follows.

Shigo, Alex L., and Edward M. Sharon.

1970. **Mapping columns of discolored and decayed tissues in sugar maple,** Acer saccharum. Phytopathology 60(2): 232-237, illus.

Columns of discolored and decayed wood associated with heartrot fungi (8-year-old inoculations) and contiguous clear wood in 10 trees (**Acer saccharum**) were mapped for specific gravity, pH, moisture, ash, microorganisms, and degree of susceptibility to decay by several heartrot fungi and a saprotter after heat sterilization. There were general patterns for the

changes in tissues and successions of microorganisms after wounding. It appeared that the heartrot fungi decayed wood only after it was altered.

WATERSHED MANAGEMENT

Baughman, Roger N., and James H. Patric.
1970. **SURBAL: computerized metes and bounds surveying.** USDA Forest Serv. Res. Note NE-110, 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A computer program has been developed at West Virginia University for use in metes and bounds surveying. Stations, slope distances, slope angles, and bearings are primary information needed for this program. Other information needed may include magnetic deviation, acceptable closure error, desired map scale, and title designation. SURBAL prints out latitudes and departures, adjusted bearings and line lengths, closure error, acreage, and a plotting of the survey to any selected scale, all at a fraction of the costs for manual methods.

Berg, William A.
1970. **Nutritional and physical aspects of plant establishment on mine wastes.** (Abstr.) Coal Age 75(4): 112.

Mine wastes are often unfavorable growth media, and special treatments and techniques are needed for plant establishment and continued growth.

Bjugstad, A. J., and W. G. Vogel.
1970. **How to manage Ozark glades for good grazing.** USDA Forest Serv. NC. Forest Exp. Sta. 4 pp., illus. St. Paul, Minn.

A brochure describing deferred-rotation grazing of glade rangelands, which provides rest periods that help prevent overgrazing and maintain vigor and good yields of native forage grasses.

Black, Peter E., and Raymond E. Leonard.
1970. **Watershed models for instructional films.** USDA Forest Serv. Res. Note NE-113, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Watershed models, with a special sponge material that simulates soil drainage, were used to make an instructional film on subsurface flow and stream flow. Construction of the models and filming techniques are described.

Blevins, R. L., N. Holowaychuk, and L. P. Wilding.
1970. **Soil genesis, morphology, and classification.** Soil Sci. Soc. Amer. Proc. 34: 460-465.

The influence of tree roots on physical properties and spatial

arrangement of adjacent soil materials was studied. Soil fabric in the tree root-soil interface was observed microscopically, using thin sections obtained from forest soils by a freezing **in situ** technique.

Corbett, Edward S.

1970. **The management of forested watersheds for domestic water supplies.** In **Multiple-use of Southern Forests Conf. Proc. 1969: 35-38.** Georgia Forest Res. Counc., Georgia Forest. Asso.

A survey of municipal forested watersheds in the northeastern United States sheds light on the role these watersheds are playing in providing water and recreation and on what the management practices are on these watersheds. Includes a review of the literature.

Czapowskyj, Miroslaw M.

1970. **Experimental planting of 14 tree species on Pennsylvania's anthracite strip-mine spoils.** USDA Forest Serv. Res. Paper NE-155, 18 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Survival and height growth of 11 coniferous and three hardwood species were studied on four anthracite strip-mine spoil types, in both graded and ungraded condition. Hardwoods performed better than conifers. Hybrid poplar NE-388 performed best. Most species performed best on graded spoils. Physical and chemical characteristics of the spoils are presented.

Czapowskyj, Miroslaw M.

1970. **Performance of hybrid poplars planted on anthracite coal mine spoils.** (Abstr.) Agron. Abstr. 1970 Annu. Meeting: 158.

Growth of 28 hybrid poplar clones on three anthracite strip-mine spoils were studied. Five-year results as related to spoil types are presented.

Czapowskyj, Miroslaw M., and Ross Writer.

1970. **Hydroseeding on anthracite coal-mine spoils.** USDA Forest Serv. Res. Note NE-124, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study was made of the performance of selected species of legumes, grasses, and trees hydroseeded on anthracite coal-mine spoils in a slurry of lime, fertilizer, and mulch. Hydroseeding failed on coal-breaker refuse, but was partially successful on strip-mine spoils.

Davidson, Walter H.

1970. **Deer prefer pine seedlings growing near black locust.** USDA Forest Serv. Res. Note NE-111, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The presence of volunteer black locust seems to make some pine species on a bituminous coal spoil more palatable to white-tailed deer. Seedlings of jack pine, pitch pine, and Austrian pine were browsed more heavily when within 10 feet of a

black locust than when farther away. The nitrogen produced by the black locust may have caused more succulent tissue in the pines. Proximity of black locust did not seem to strongly influence browsing of other pine species in the study area.

Davidson, Walter H.

1970. **Planned program of tree and shrub planting enhances beauty of America's Great Plains.** Nat. Acad. Sci. Highway Res. News 40: 22-26, illus.

Basic information for planning shrub and tree screens along highways in the Great Plains, including a list of trees and shrubs and their suitability for different soils and plant-hardiness zones.

Davis, Grant.

1970. **Research on revegetation and hydrology of surface-mined areas.** (Abstr.) Coal Age 75(4): 112.

Attempts to find plants that will grow on hostile sites are continuing, but adapting plants to adverse conditions is not always possible. In some instances, the sites must be modified. The best solution to problem spoils is to prevent them from forming.

Federer, C. Anthony.

1970. **Measuring forest evapotranspiration—theory and problems.** USDA Forest Serv. Res. Paper NE-165, 25 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Only the soil-water budget and the micrometeorological methods offer any degree of success in measuring forest evapotranspiration. The author discusses these procedures, pointing out the limitations of the soil-water sampling method, but noting that the micrometeorological approach provides several related methods that offer the best opportunities for accurately measuring evapotranspiration.

Federer, C. Anthony.

1970. **Review of "Climate and Agriculture; an Ecological Survey" by Jen-hu Chang.** Amer. Meteorol. Soc. Bull. 51: 439-440.

Book review.

Hornbeck, J. W.

1970. **The radiant energy budget of clearcut and forested sites in West Virginia.** Forest Sci. 16: 139-145, illus.

Radiant-energy budget components were measured over a clearcut site and a hardwood forest site on a gaged watershed in West Virginia. Results show that clearcutting caused changes in both albedo and upward thermal radiation values. The magnitude of these changes varied by season of the year. Despite the seasonal variability, net radiation values for the two sites did not differ greatly except during periods of snow cover.

Hornbeck, J. W., R. S. Pierce, and C. A. Federer.

1970. **Streamflow changes after forest clearing in New England.** Water Reseources Res. 6: 1124-1132, illus.

Clearing a hardwood forest cover and preventing regrowth with herbicides on a 39-acre watershed in central New England increased annual water yield an average 12.2 area-inches for the first 2 water-years after treatment. Most of this increase occurred during the critical low-flow months of June through September, and the amount was governed in large part by rainfall in this period. There was a small advance of snowmelt runoff and a consistent increase in growing-season high-flow values.

Johnson, Noye M., Gene E. Likens, F. H. Bormann, D. W. Fisher, and R. S. Pierce.

1969. **A working model for the variation in streamwater chemistry at the Hubbard Brook Experimental Forest, New Hampshire.** Water Resources Res. 5(6): 1353-1363.

Streamwater chemistry varied hyperbolically with stream discharge through four decades of discharge change within the Hubbard Brook Experimental Forest. This dilution process is most simply explained by the mixing of rain water or surface water with deeper soil water. Sodium and silica concentrations in stream water are markedly diluted during high discharge periods while hydrogen ion, aluminum, and nitrate concentrations are increased.

Ketchledge, E. H., and R. E. Leonard.

1970. **The impact of man on the Adirondack high country.** N. Y. Conservationist 25(2): 15-18.

A reconnaissance survey of the foot trails on the major peaks in the Adirondacks indicates that trail erosion is geographical in extent and varies from minor to severe on different peaks. In some cases, the trails are eroding at a rate of 1 inch per year. Fertilizer and grass seed trails were inaugurated to stabilize some of the heavily eroded areas.

Klawitter, Ralph A.

1970. **Small watershed program—the forest research assessment.** Nat. Watershed Cong. Proc. 17: 161-165.

The early objective of the Small Watershed Program in the South—flood prevention—gave little consideration to the adverse effects on forestry, fish, and wildlife habitat. However, changes in program emphasis encouraged preservation of the forest environment. Greatly intensified research is needed to develop land-treatment measures for the Program that will enable us to enhance the forest environment so we can meet the needs of tomorrow.

Klawitter, Ralph A.

1970. **Water regulation on forest land.** J. Forestry 68: 338-342, illus.

The objective of water regulation on wet forest land is to increase timber production. Other objectives are to improve wildlife habitat and range land and flood control on wetland

forests. Each kind must receive a prescription suited to local peculiarities. However, the measures applied must be well enough understood and controlled to enable changes in design and shifts in productivity from one resource use to another as the future demands.

Kochenderfer, James N.
1970. **Erosion control on logging roads in the Appalachians.** USDA Forest Serv. Res. Paper NE-158, 28 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Practical methods of controlling erosion on logging roads are summarized through the different stages—planning, location, drainage, maintenance, and care after logging. The material was derived from existing literature, road lore, contact with experienced land managers, and personal experience.

Kochenderfer, James N.
1970. **Erosion control on logging roads.** In Forest Eng. Workshop on Forest Roads Proc. 71 (1-4): 10. Morgantown, W. Va.
Public displeasure over erosion and stream pollution and damage to forest aesthetics caused by logging is growing. Unless the timber industry polices itself, restrictive legislation may result.

Kochenderfer, James N., and James H. Patric.
1970. **Effects of clearcutting—past and present—on water resources of the Monongahela National Forest.** W. Va. Agr. and Forestry 3(3): 5-11.
Problems of flooding, drought, and soil erosion usually arose when coniferous forests were ruthlessly exploited, then burned. These problems need not arise on responsibly managed forest land. Clearcutting increases water yield from hardwood forest land, and little or no damage to water quality results when forest roads are properly built and properly managed.

Leaf, Albert L., J. V. Berglund, and R. E. Leonard.
1970. **Annual variation in fertilized and/or irrigated red pine plantations.** Soil Sci. Soc. Amer. Proc. 34: 677-682.
Spatial and temporal variation in foliar, morphological, and chemical variables, and responses to fertilization and irrigation treatments were quantified in near-terminal, current-year autumnal foliage from 40-year-old red pine plantations. Though foliar analysis is a valuable diagnostic technique, care is needed in interpreting data obtained by this technique because of the variation and basis of expression of results.

Leaf, Albert L., and Raymond E. Leonard.
1970. **Forest fertilization and/or water quality?** S. Lumberman 221(2752): 90-91.
Is forest fertilization a potiential source of water pollution? We need to define water-quality standards and to study the movement of the nutrients through the watershed and how the nu-

trients affect the nutrient cycle; and we also need to determine effects of fertilizer formulation and application rates.

Leonard, Raymond E., and Sally B. Parr.
1970. **Trees as a sound barrier.** J. Forestry 68: 282-283, illus.
Some of the factors involved in using trees as a sound barrier are discussed. In general, forest stands were found to absorb 6-8 decibels per 100 feet.

Likens, Gene F., F. Herbert Bormann, Noye M. Johnson, D. W. Fisher, and Robert S. Pierce.
1970. **Effects of forest cutting and herbicide treatment on nutrient budgets in the Hubbard Brook watershed-ecosystem.** Ecolog. Monogr. 40(1): 23-47.
All vegetation on a watershed of the Hubbard Brook Experimental Forest in New Hampshire was cut during the fall of 1965, and vegetation regrowth was inhibited for 2 years with herbicides. Large increases in streamflow and in streamwater concentrations of most major ions were observed. Increases were noted in hydrogen ion content, streamwater temperatures, electrical conductivity, and stream turbidity.

Patric, James H.
1970. **Logging roads and water quality.** In Forest Eng. Workshop on Forest Roads Proc. (71) 1-4: 11-16. Morgantown, W. Va.
Logging has historically been associated with stream pollution: and improperly located, used, or maintained logging roads are the major cause of pollution in forest streams. Eroded soil, dissolved plant nutrients, and petroleum products from logging equipment are pollutants associated with logging roads.

Patric, J. H.
1970. **Some principles of forest hydrology pertinent to even-aged management of eastern hardwoods.** N. Logger 19: 14-15, 26-27, illus.
Principles distilled from almost 60 years of forest hydrology research leads the author to conclude that even-aged management of eastern hardwoods can cause water benefits that considerably exceed water damages.

Patric, James H.
1970. **Combined weather and vegetation modification promises synergistic streamflow response.** J. Hydrol. 11: 316-317.
Letter to the editor. The author criticizes Satterlund's proposal that forests be managed to decrease potential evapotranspiration (PET) and thereby to increase streamflow, taking issue with the context in which PET was used by Satterlund. By definition, potiential evapotranspiration is a climatically determined concept that is safe, at the moment, from tampering by forest managers.

Patric, James H., and John Campbell.

1970. **Some experiences with Dicamba in controlling revegetation of deforested land in West Virginia.** NE. Weed Contr. Conf. Proc. 24: 61-68, illus.

To maintain barren conditions on deforested land in West Virginia, liquid and pelleted formulations of Dicamba were applied in 1969. A liquid formulation (per-acre application of 1.5 lb. a.e. Dicamba with 1 lb. a.e. each of 2,4-D and 2,4,5-T in 80 gallons of water) provided quick and more complete kills at less cost than larger amounts of 2,4-D and 2,4,5-T in water. Experiences with pelleted Dicamba suggest that heavier applications of this formulation will be needed to maintain barren conditions and that application early in the growing season is at least as important as amount applied.

Pierce, Robert S., J. W. Hornbeck, G. E. Likens, and F. H. Bormann.

1970. **Effect of elimination of vegetation on stream water quantity and quality.** Symp. Results of Res. on Representative and Exp. Basins Proc.: 311-328, illus. Wellington, New Zealand.

A forested mountain drainage with glaciated soils and tight bedrock in central New Hampshire was cleared of all vegetation and treated for 3 years with herbicides to minimize growth. Streamflow increased, and stream water chemistry changed radically—a significant change in water quality and loss of nutrients.

Reinhart, K. G.

1970. **Status of findings on effects of deforestation and reforestation, eastern United States.** (Abstr.) Trans. Amer. Geophys. Union 51 (4): 289.

Cutting or killing all vegetation, without destruction of the forest floor, has increased annual water yields. Effects of reforestation are the opposite of those from deforestation. The effects of such forest treatment must be considered with other land uses involved.

Sopper, William E., and Howard W. Lull.

1970. **Streamflow characteristics of the Northeastern United States.** Pa. State Univ. Agr. Exp. Sta. Bull. 766. 129 pp., illus.

To obtain a better understanding of the characteristics of streamflow in the Northeast as a basis for extending and applying research results from experimental watersheds, the authors studied the relationship of water-yield parameters to selected variables in the seven major physiographic regions in the Northeast and the representativeness of small experimental watersheds in relation to the region in which they are located.

Trent, Roy E., R. O. Weedfall, and W. H. Dickerson.

1970. **West Virginia climate in relation to weather sensitive industry** W. Va. Univ. Agr. Exp. Sta. Bull. 591T. 26 pp. Morgantown, W. Va.

This reports the probability of meteorological variables occurring in West Virginia and partially reflects the effects of these conditions on comfort. The results are established for application to weather-sensitive industries such as forestry, agriculture, and outdoor recreation.

Troendle, Charles A.
1970. **Water storage, movement, and outflow from a forested slope under natural rainfall in West Virginia.** (Abstr.) Trans. Amer. Geophys. Union 51(4): 279.

A 50-foot trench at the base of a 175-foot slope on a gaged watershed intercepted water moving downslope above the bedrock and directed it into a small HS flume. Other instruments measured the presence and energy status of moisture in the soil and aided in interpretation of plot and watershed responses.

Troendle, Charles A.
1970. **The flow interval method for analyzing timber harvesting effects on streamflow regimen.** Water Resources Res. 6: 328-232.

A flow interval method for determining the timing of significant portions of annual streamflow was applied to the discharge data from five small mountain watersheds (four treatment watersheds and one control watershed) in West Virginia. Different degrees of timber harvesting had various effects on interval length and occurrence. The heavier cuttings caused an apparent lengthening in the shortest 25-percent and 50-percent intervals. In nearly every instance, harvesting resulted in a decrease of the longest 1-percent and 5-percent intervals.

Troendle, Charles A.
1970. **A comparison of soil-moisture loss from forested and clearcut areas in West Virginia.** USDA Forest Serv. Res. Note NE-120, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Soil-moisture losses from forested and clearcut areas were compared on the Fernow Experimental Forest. As expected, hardwood forest soils lost most moisture while revegetated clearcuttings, clearcuttings, and barren areas lost less, in that order. Soil-moisture losses from forested soils also correlated well with evapotranspiration and streamflow.

Troendle, Charles A., and James D. Phillips.
1970. **Evaporation—rain falling up.** W. Va. Agr. & Forestry 3(2): 5, 11-12, illus.

Data collected at the U. S. Weather Bureau Climatic Station at the Timber and Watershed Laboratory in Parsons, W. Va., were used to develop equations for estimating daily pan evaporation from solar radiation, wind speed, air and water temperatures, and barometric pressure. Then the factor used to estimate potential evapotranspiration from pan evaporation was corrected for local climatic conditions.

Vogel, Willis G.
1970. **Weeping lovegrass for vegetating strip-mine spoils in Appalachia.** First Weeping Lovegrass Symp. Proc. 1: 152-162. Noble Found., Ardmore, Okla.

Weeping lovegrass produces quick cover on a wide range of spoil conditions and is more tolerant of extremely acid spoils, dry sites, and summer growing conditions than most of the commonly used cool-season grasses and legumes. Nitrogen and phosphorus fertilizers are needed for establishing quick cover of lovegrass on many Appalachian coal-mine spoils.

Whipkey, R. Z.
1970. **Water control on experimental forest watersheds.** J. Soil and Water Conserv. 25: 238-239, illus.

Part of the Northeastern Station's work with water control on experimental forests is concerned with techniques for altering the timing and quantity of storm discharge from forests. The author discusses techniques of studying both surface and subsurface flows.

Worley, David P., and James H. Patric.
1970. **Economic evaluation of some watershed management alternatives on forest land in West Virginia.** (Abstr.) Trans. Amer. Geophys. Union 51(4): 280.

Timber and water research conducted at the Fernow Experimental Forest provides a 10-year record of timber growth and streamflow. Streamflow increases were evaluated in terms of timber growth foregone.

FOREST RECREATION

Echelberger, Herbert E., and Elwood L. Shafer, Jr.
1970. **Snow + (X) = Use of ski slopes.** J. Marketing Res. 7: 388-392.

Several factors besides snow influence the use of ski areas. Factor and multiple-regression analyses were used to establish relationships among 16 independent variables and volume of business at 26 ski areas in the Northeast. Equations are presented that explain a major portion of the variation in use of ski areas, depending upon the prevalent snow conditions.

Echelberger, Herbert E., and Elwood L. Shafer, Jr.
1970. **Some managers' viewpoints on campers and campground operation.** Park Practice Guideline. Dec. Admin. 44, 4 pp.

Nine managers of public campgrounds comment on their relations with their campers and some of the management problems they have. Topics include camping fees, reactions to survey interviews, registration procedures, campers' pets, and maintenance of facilities. Reprinted from Research Note NE-88.

Hopkins, W. S., and W. F. LaPage.
1970. **The future of American forest recreation areas.** World Forest Congr. Proc. 6 Vol. III: 3610-3617.
A discussion of the effects of technology, broadening recreation demand, growing sophistication of the recreationist, competition, growth of organized interest groups, and maturation of public recreation policy on the future of recreation in the U.S. (Summaries in French and Spanish).

LaPage, W. F.
1970. **Campground and camper market research.** Trends in Parks and Recreation 7(1): 7-12, illus.
A discussion of the relation of research efforts in family camping to several marketing theories, such as brand loyalty, frequency of purchase, and price awareness. Relationships between findings from camper market research and campground-management goals and alternatives and the expanding role of private enterprise in providing outdoor recreation opportunities are emphasized.

LaPage, W. F.
1970. **Campground and camper market research.** Family Camping Leader 7(3): 1-8.
Same as above.

LaPage, W. F.
1970. **Meeting the social needs of tomorrow's campers.** Planning Tomorrow's Campground Workshop Proc. Univ. Vt. Ext. Serv. Brieflet 1197: 6-18.
The author defines the social needs involved in recreation processes. The challenge is to develop and manage campgrounds that will pry campers loose from their air-conditioned TV-equipped vehicles for a few hours each day to enjoy and appreciate natural and man-made beauty, to make them want to stay longer and return more often.

LaPage, Wilbur F.
1970. **The mythology of outdoor recreation planning.** S. Lumberman 221(2752): 118-121, illus.
Camping and many other forms of outdoor recreation seem to thrive on myths and romantic half-truths, including the myth of increasing leisure time, the myth of increasing per-capita participation, the return-to-nature myth, the myth of perfect market knowledge, and the myth of future decision-making.

LaPage, W. F., and Dale P. Ragain.
1970. **Trends in camping participation.** (Abstr.) Sociol. Abstr. 18(5): 902.
Camping and total outdoor recreation participation declined in a panel of 565 campers during the period 1964 to 1969. The volume and trend of camping participation is examined in terms of three broad categories of behavioral influences: (1) life cycle and changing leisure interests, (2) opportunity limita-

tions on participation, and (3) habit patterns and styles of participation.

Shafer, Elwood L., Jr.
1970. **The name of the game is recreation research.** Environ. Educ. 2(1): 30-34, illus.
To explore the possibilities of a systems-analysis approach in solving outdoor-recreation problems, methods of attacking problems via recreation systems are outlined, with special emphasis on obtaining models that predict management alternatives. Three environments for recreation research and their related systems are described.

Shafer, Elwood L., Jr., John F. Hamilton, Jr., and Elizabeth A. Schmidt.
1970. **Natural landscape preferences: A predictive model.** Ekistics 29(173): 278-283, illus.
A study was conducted to identify what quantitative variables in photographs of landscapes are significantly related to public preferences for those landscapes. An equation was developed that used six variables and accounted for 66 percent of the variation in preference scores for photographs of landscapes.

Shafer, Elwood L., Jr., and James Mietz.
1970. **It seems possible to quantify scenic beauty in photographs.** USDA Forest Serv. Res Paper NE-162, 12 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
This study was made to test how well a mathematical model could predict landscape preferences of recreationists near Salt Lake City, Utah. Although the model was developed in the Northeast, study results suggest that it can be used to predict landscape preferences of recreationists throughout the United States.

WILDLIFE HABITAT

Cowan, R. L., J. S. Jordan, J. L. Grimes, and J. D. Gill.
1970. **Comparative nutritive values of forage species.** **In** Range and Wildlife Habitat Evaluation—A Research Symposium. USDA Forest Serv. Misc. Pub. 1147. 220 pp.
Data from which to predict nutritive value or carrying capacity of units of deer range is lacking. Small-scale laboratory tests need to be developed for evaluating forages. The **in vivo** nylon bag technique appears satisfactory for determining relative digestibility of forage samples and shows promise as an intermediate step in calibration of methods involving only chemical analysis of forage.

Jordan, James S.
1970. **Deer habitat management in eastern forests.** J. Forestry 68: 692-694, illus.
Deer habitat management in eastern forests is concerned primarily with the management of deer food. But the present capability of such management to solve food problems has consistently been overestimated. Current management practices are of questionable value because data about their specific effects on deer are generally lacking. A research process in which major research tasks are arranged in a natural and logical progression and which leads to the development of reliable systems of deer-food management is proposed as one method of solving current problems.

Jordan, James S.
1970. **Forest habitat management for non-consumptive uses of wildlife.** Wildlife Soc. NE. Sect. Trans. 27: 89-96.
Because of rapidly increasing use of forests by outdoor recreationists and widespread public concern about the future of natural environments, forest habitat management should be expanded to include any wildlife species. Two main approaches are proposed: (1) increase the frequency of wildlife use of selected areas, and (2) influence the growth of wildlife populations.

Jordan, James S.
1970. **Pennsylvania's timber and deer resources have been wasted.** Warren Times-Mirror and Observer. 10 Dec. 5(223): B26-B27.
Foresters and sportsmen have alined themselves on opposing positions in the timber-deer conflict. The two positions are described. Other groups with an interest in the forest environment should also be heard. Improved deer-herd control must be combined with the development of systems of deer-food management if the management of timber and deer is to be coordinated successfully.

Jordan, James S.
1970. **The timber-deer conflict: A need for understanding.** S. Lumberman 221(2752): 92-93.
Same as above.

Pack, J. C., and J. W. Thomas.
1970. **Calling all turkeys.** Wonderful W. Va. 34(8): 16.
Hunters who used turkey callers had nearly twice as much success as those who did not use callers. Types of callers and their uses are discussed.

Pogge, Franz L.
1970. **Rooting sassafras cuttings.** Tree Planters' Notes 21(2): 28-29, illus.
Six types of cuttings were tested under greenhouse conditions. Best rooting was obtained from root cuttings with a live stem

sprout, planted vertically; and from large root cuttings planted horizontally. Stem cuttings failed to sprout.

Thomas, J. W., R. M. Robinson, and R. G. Marburger.
1970. **Studies in hypogonadism in white-tailed deer.** Texas Parks & Wildlife Dep. Tech. Ser. 5: 50 pp., illus.
Hypogonadism in white-tailed deer in the Central Mineral Region of Texas was studied from 1962 to 1967. Both the social and the physiological aspects of the deer were studied.

FORESTRY ENGINEERING

Biller, Cleveland J.
1970. **Costlier skidder tires may be cheaper in the long haul.** Can. Forest Ind. 90(7): 55-57, illus.
A cost study comparing the two general types of tires available for log skidders—those with nylon cord lining and those with a reinforcing layer of shredded steel wire—indicate that although the tires with shredded wire reinforcement cost more, they are also more economical in use. Research from studies of farm tractors indicates that air-filled tires with wheel weights outperform those totally filled with water.

Biller, Cleveland J.
1970. **Some observations on causes of skidder tire wear.** N. Logger 18(5): 24-25, 38, illus.
The article relates pertinent factors in the logging operation to tire wear and points out how tire wear can be decreased.

Biller, Cleveland J.
1970. **Tables for estimating skidder tire wear.** USDA Forest Serv. Res. Paper NE-168, 12 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
By using this set of 11 tables prepared for different makes of wheeled skidders and different tire sizes, the logging operator can estimate how much tire wear will result on a particular logging job. The most critical factor is the rockiness of the skidroads.

Biller, Cleveland J., and Robert L. Hartman.
1970. **Buying a used skidder?** Pulpwood Prod. 18(5): 46, 50, 52, illus.
Some practical pointers on buying a used wheeled skidder.

Biller, Cleveland J., and Robert L. Hartman.
1970. **Tractive characteristics of wheeled-skidder tires.** Amer. Soc. Agr. Eng. ASAE Paper No. 70-615. 12 pp., illus. Winter Meeting, Chicago.
Wheel revolutions and load were measured over a test area for

different tread depths and soil-moisture contents to determine optimum replacement or retread point.

Hartman, Robert L., and Harry G. Gibson.
1970. **Techniques for the wheeled-skidder operator.** USDA Forest Serv. Res. Paper NE-170. NE. Forest Exp. Sta., Upper Darby, Pa.
From studies of the operation of wheeled skidders in mountainous Appalachian terrain, ways are suggested that new or experienced skidder operators might improve their operating ability and thus increase their production.

Hartman, Robert L., and Ross A. Phillips.
1970. **Bunching with the wheeled skidder.** N. Logger 19(4): 32-33, illus.
Guidelines are needed for increasing the efficiency of the wheeled skidder in bunching operations. This paper discusses the results to date of research done in West Virginia with this type of operation. Winching speed and skidder position are discussed, and some data on winching tests are presented.

Phillips, Ross A.
1969. **Discussion of public and private forest engineering roads.** Forest Eng. Education Conf. ASAE Pub. Proc-170: 54-55.
A discussion of how a forest engineer should be trained, and a summary of probable duties performed.

Phillips, Ross A.
1970. **Potential of front-end log loaders.** Amer. Soc. Agr. Eng. 12 pp., illus. Winter Meeting, Chicago.
A discussion of the factors that influence log loading with a rubber-tired front-end loader (heavy-duty farm tractor), and the potential and requirements of such a loader in Appalachia.

Phillips, Ross A., and Robert L. Hartman.
1970. **Log loading with a rubber-tired front-end loader.** N. Logger 19(5): 16, 17, 26, 27, illus.
A study of the performance of a heavy-duty farm tractor with a front-end loader on a log deck may help a logger decide how a similar piece of equipment could improve his operation.

Smithson, Paul, and Ross A. Phillips.
1970. **Skidroads for logging operations in the Appalachians.** Forest Eng. Workshop on Forest Roads Proc. 71(1-4): 17-23. illus. Morgantown, W. Va.
Planning and location are the most important aspects of building a skidroad, for a well-planned and well-located road is relatively easy to construct and to maintain. The authors discuss the planning, location, construction, maintenance, and cost of a skidroad in the Appalachians.

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